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PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

No. 19,411, A.D. 1929.

Improvements relating to Machines for Assembling Driving Chains.

We, HANS RENOLD LIMITED, a Company organised under the laws of Great Britain, and ALFRED RENSHAW, a British Subject, both of Burnage Works. Didsbury, Manchester, do hereby declare the nature of this invention to be as follows:—

This invention relates to machines of the rotary type for assembling the elements of jointed transmission chains and is particularly applicable to the assembly of duplex and triplex bush roller driving chains, that is to say, chains consisting of two or three sets of link plates mounted side by side on the studs, but the invention can also be conveniently employed in the assembly of the multiple link type of inverted tooth chains. The invention is not, however, limited to the assembly of these types of chains, as generally speaking. it may be employed in putting together any chains in which link plates have to be fixed to solid or hollow studs or similar cylindrical jointing members.

According to the present invention the cylindrical members are first fed into the machine in which they are set up in their proper spaced relation in notches or recesses in a rotating table or like member and these cylindrical joint members which will usually be solid studs, are themselves used as the members on which the link plates and other units are placed in correct registration. Although a circular revolving table has been referred to the invention can also be applied to a machine in which the joint members are set up on a carrier moving in a horizontal plane, such as, for example. a flexible conveyor formed with the notches or recesses to receive the joint pins. In actual practice, however, it is preferred to employ a revolving indexing table around which are spaced a number of tool stations. The tools for effecting the different assembling operations may be carried upon a vertical ram in their appropriate positions so that at each stroke of the ram an operation can be completed at each station. The vertical ram passes through the centre of the indexing table which is rotated intermittently at each stroke of the ram by an angular amount just sufficient to bring the next set of elements into the path of the tools at each station. The ram itself may be operated in any desired manner, for example, as is common in punching machines by a cam or by crank and connecting rod mechanism. Around the indexing table a number of slides are placed radially so as to feed the necessary components into the correct position for the operation of the tools.

It is thought that the nature of the invention can be explained most clearly by taking an example of a specific chain construction and considering its assembly step by step. For this purpose the assembly of a duplex chain will be considered in detail. It will be realised that the chain comprises a series of long studs; centre link plates are pressed on to the studs so as to take up a central position. Next, the so called inner link combinations each comprising two inner link plates forced on to two hollow bushes have to be placed in position so as to connect together two studs passing through holes in adjacent centre links. Then the outer or covering links have to be placed on the same pairs of studs as the centre links which completes half the chain. The chain is then in fact turned over and on the other side the inner link combinations and the outer or covering plates are placed in position to finish the chain.

The first half of the chain, that is to say, the assembly operations excluding the assembly of the second inner link combinations and the second set of covering plates, is carried out at one passage through the machine.

At the first station a radial slide advances with two studs in spring jaws

[*Price* 1/-]

at its forward end, while in the innermost position two spring-pressed plungers move down with the ram, pushing the studs into the notches in the edge of the rotating table and between the rotating table and the outer stationary base plate. The slide is then drawn back leaving the studs in position. At the second station a radial slide presents a centre link plate in the horizontal position, so that two plungers become threaded through the holes. Subsequently, the block in which the punches slide comes down and presses the centre link over the upstanding studs, the latter entering the holes in the block and compressing the springs behind the punches. By means of this block the link plate is pushed down to the centre of the stud.

At the third station, the so-called inner combinations each comprising two inner link plates forced on to the ends of hollow studs are fed forward radially in a horizontal position and are pushed down on to the studs into their correct position. Finally, at the fourth station the outer covering plate is fed radially inwards and is pushed on in a manner similar to the centre link although it is of course only just pushed on to the ends of the studs.

The movements of the radial slides are carried out by means of cams so timed as to allow the slides to dwell in their innermost position while the plungers in the vertical ram of the machine enter holes in the components, retaining the latter while the slides are withdrawn and the plungers then complete their strokes to assemble the parts.

As already pointed out this does not complete the chain, for it has to be turned over and passed through a second machine in order that the other inner link combinations and covering plates can be added to the opposite ends of the studs. In this machine the central revolving part forming the indexing table is in the form of a chain wheel with which the assembled half of the chain can engage. Furthermore, in this machine the tools are simpler as it is only necessary to assemble the inner combinations and the covering plates so that the stud feeding mechanism and the mechanism for feeding the central plates and the tools for assembling them used in the first machine, may be omitted from the second machine. The chain comes out from the second machine in completed lengths.

It is often desired for the chains to be assembled in predetermined lengths and the machine may be fitted with an automatic device for ensuring this. This device is provided at the first station where the studs are fed and will at intervals prevent a pair of studs being fed forward when the desired length of chain has been fed into the machine. For example, a pattern chain of the desired length may be moved step by step over a sprocket wheel as the indexing table is changed and it may have a cam attached to one link which in its path strikes a detent which serves to lock together two parts of the feed slide for the studs. When, however, the cam raises the detent the two parts of the slide are disconnected and the feed part is not then fed forward. However, when the pattern chain moves on to the next link the detent is spring returned and at the next cycle the feed slide for the studs resumes its normal operation.

In conjunction with this feature a device is provided at the second station for preventing the feeding forward of a centre link when the gap in the indexing table without any studs arrives at number two station. The arrangement may be that as there are no studs to resist the downward movement of the plungers the block comes straight down and rocks a pivoted bar which prevents the inward radial movement of the forward part of the slide for feeding the centre link plates. Also, a similar device is furnished at number four station, which prevents the feeding of an outside covering link plate when no pair of studs arrive at the fourth station.

In completing the chain in the second machine a similar device will ensure that the outer link plate is not applied to the opposite side of the chain when the gap in the chain arrives at the station in question.

It will be noted that the novel machine has various advantages. In particular the studs themselves are employed as the locating devices for the various components subsequently assembled on to it. Moreover, owing to the fact that all the components are applied on top and are thus assembled and can be readily seen and no assembling step is carried out on the lower ends of the studs, the assembly operation is better and safer and more completely under the supervision of the operator. Also, the feed slides may be located so far apart that there is ample opportunity for the operator to insert by hand any components which may have been missed or to rectify any which may have been misplaced. Further, the device which prevents feeding of the components when a gap arrives without any studs, enables chains to be made in a convenient fashion of known length without including any loose parts or half assembled components. Yet again, better assembly is obtained by pressing a link on to two

studs, rather than by pressing two studs into a link plate as has been usual previously, because a flat punch may be used for pressing down the plate and it can be easily reground and its flat surface maintained. The principles of employing studs in suitable notches to locate the various components makes it unnecessary to employ plungers in the indexing table which can sink down or disappear against the pressure of a spring. This naturally involves considerable simplification from the tool making point of view. Finally, the tools can be mounted in subpresses detachably carried in the ram, so that they can be removed as complete units and quickly replaced by a fresh set of tools already set up and adjusted. This obviously saves a good deal of time if any tools become damaged or if it is desired to change over from assembling one type of chain to another type of chain.

The advantage due to pressing a link plate on to the studs instead of pressing studs into a link in the usual fashion may be practically appreciated when the machine is used for making chain elements comprising two studs connected by a link plate. In this case the studs are placed in the notches and stand vertically and the link plate is located entirely by its holes. On the other hand, when in the usual fashion a link plate is fed into suitably shaped recesses the tools have to be recessed and are difficult to keep in good order.

In applying the invention to the assembly of a multiple link inverted tooth chain, the procedure is much as described above, except that more feeding stations are required depending upon the width of the chain, that is to say, on the number of links to be assembled transversely across the chain. In this case also an operation in a second machine will be necessary, in which machine the indexing table has the profile of a wheel which can engage with the part of the chain assembled in the first machine. In these inverted tooth chains small washers have to be assembled on to the extreme ends of the studs. They are therefore, fed in one station in each of the two machines and take the place of the outer covering link plates already referred to.

The novel machine allows tools of a very simple design to be employed which are accessible for inspection purposes, and for clearing away bad components. Suitable feed hoppers are provided for automatically delivering the components to their various feeding stations. In the duplex chain first described, the studs are automatically fed at the first station. A stacking arrangement is provided which automatically stacks the centre link plates on wires and the latter are then suspended at the second feed station. A feed hopper is provided for automatically feeding the inner combinations into the correct position at the third station, while at the fourth station there is a link stacking arrangement similar to that at the second station.

Dated this 24th day of June, 1929.

For the Applicants:
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PROVISIONAL SPECIFICATION.

No. 21,852, A.D. 1929.

Improvements relating to Machines for Assembling Driving Chains.

We, HANS RENOLD LIMITED, a Company organised under the laws of Great Britain, and ALFRED RENSHAW, a British Subject, both of Burnage Works, Didsbury, Manchester, do hereby declare the nature of this invention to be as follows:—

This invention relates to machines of the rotary type for assembling the elements of jointed transmission chains of the kind comprising link plates and cylindrical jointing studs.

In the provisional specification of our co-pending application No. 19,411/29 (Serial No. 331,093), a machine is described in which a rotating assembling table first receives studs which it holds (in notches in its edge) in proper spaced relation while further components are supplied to the studs from a succession of supply-stations. These further components were all passed over the studs from the same side of the table, and therefore the chain leaves the machine only partly assembled and has to be turned upside down and passed through a similar machine in which the final components, which can only be supplied to the ends of the studs which were inaccessible during the first series of operations, are assembled therewith.

It is the principal object of the present invention to provide a machine in which all the components of the chain are assembled in one passage through the machine. Accordingly, a sprocket-wheel is mounted to rotate adjacent to the assembling-table and in the same or substantially the same plane as the table, a guide-surface is provided which strips the studs (carrying some of the components) from the assembling table and transfers them to the spaces between the sprocket teeth, and a final supply station is provided which supplies the finishing components to the other ends of the studs, while supported by the sprocket-wheel.

The machine described in the aforementioned specification was primarily intended for assembling duplex or triplex chains, or similar chains in which certain of the assembling operations could be completed while the relatively long studs were held in the assembling table with a considerable proportion of their length inaccessible. In the case of single-strand chains it would be impossible to complete any assembling operations in such a machine, because the bushes which fit around the studs occupy nearly the whole length of the studs when the chain is assembled. Consequently, if an adequate proportion of the length of the studs is held in the assembling table the upper ends of the studs will not protrude through the bushes when the inner combinations are placed in position on the studs.

It is a further object of the present invention to provide an assembling-machine on which single-strand chains can be assembled, either partly or wholly, notwithstanding the difficulty mentioned above.

According to this feature of the invention an assembling-table and a sprocket-wheel adjacent thereto are provided as described above, the studs being fed to and held in the table with an adequate proportion of their length engaging the notches or the like in the table, and the so-called "inner combinations", each consisting of two bushes and two inner link-plates, are fed thereto, a guide surface is provided which strips the studs from the assembling table, transfers them to the spaces between the sprocket teeth and thereafter retains them therein during their travel around the sprocket, and means (for example a fixed inclined plane) are provided for pushing the studs lengthwise, after they have been transferred as aforesaid, a distance such that the ends over which the bushes were placed project beyond the bushes.

At this stage the studs are in a condition to receive the outer link-plates on one side, after which the chain is in a partly-assembled condition similar to the condition of a duplex or triplex chain after partial assembly on the machine described in the aforesaid provisional specification; and it would be possible to transfer the chain in this condition to a second machine in which the outer link-plates for the other side are assembled from above. It is, however, preferred to provide a final supply station which supplies these outer link-plates to the studs while still supported by the sprocket-wheel, as in the form of the invention first described above.

A machine embodying the above and other features of the invention, will now be described by way of example as applied to the assembly of single-strand chain. In this embodiment an assembling-table rotated step-by-step in a horizontal plane has notches in its periphery spaced apart according to the pitch of the chain and of such a width as to fit the studs closely. Surrounding the table is a guide-member or shroud the inner edge of which retains the studs in the notches. This guide-member or shroud has a gap therein for a purpose to be described.

A stud supplying station is provided with a radial slide which advances with two studs in spring jaws at its forward end, and when in its inner position it brings the two studs into position above two of the notches. Spring-pressed plungers then move downwards and push the two studs into the notches, whereupon the slide retreats and the table rotates to bring the studs to the next station at which an inner combination is passed over the two studs. A plate situated beneath the table serves as an abutment for the lower ends of the studs. These operations continue, resulting in the assembly of successive pairs of studs with inner combinations. A sprocket-wheel, rotated in synchronism with the table but in the opposite direction, is located in tangential relation thereto, the gap in the shroud being at the point where the sprocket-wheel is nearest to the table. As the table and the sprocket-wheel rotate, the teeth of the sprocket-wheel enter between the bushes of the chain immediately above the table. A second shroud partly surrounding the sprocket-wheel extends over the table in one direction to a point more or less in line with the axes of the table and the sprocket-wheel, and as the bushes reach this end of the shroud they are guided away from the table. At this point there is a gap in the shroud surrounding the table, as previously mentioned, and therefore the studs are able to leave the notches in the edge of the

table. Consequently the inner combinations, with the studs in place therein, are transferred from the table to the sprocket-wheel and travel round therewith, being kept in place by the shroud.

At this stage, the studs, still resting on the plate mentioned above, do not protrude above the upper link-plates of the inner combinations, for the reason already explained, and therefore the outer link-plates cannot be assembled therewith. The plate, however, is continued beneath the sprocket-wheel as an upwardly-inclined plane from the point where the studs leave the notches in the table, this inclined plane extending for about 45° from that point and its use being such that the shoulders of the upper ends of the studs are brought well above the top faces of the link-plates of the inner combination. At the end of this inclined plane the plate extends further around the sprocket-wheel parallel thereto. The third supply-station is situated at the beginning of this parallel portion of the plate, and it supplies outer-link-plates and forces them on to the ends of the studs.

The fourth supply-station is situated beneath the sprocket-wheel at the end of the raised parallel portion of the plate, which terminates altogether at this point. A resistance block is placed above the chain to take the pressure of the tools which supply outer link-plates to the lower ends of the studs and force them thereupon and the lower surface of the resistance is flared or inclined slightly at its entering end so as to cause the studs, as they come to the end of the supporting-plate, to ride under the resistance block and to be pushed downwards to their full extent.

The tools which press the various components into place are carried by three rams, firstly a light ram carrying the tools for pushing the studs and the inner combinations into place, a second heavier ram for pressing the upper outer link-plate on to the studs and a third similar ram for the lower outer link-plates. These rams are automatically operated at the proper times by means of cams.

As in the above mentioned specification a counting mechanism may be employed which, at given intervals, will leave out two studs and a mechanism which registers on the studs will leave out unwanted components thus giving an assembled chain of known length without any loose parts.

It will be appreciated that a machine according to this invention for assembling duplex or triplex chains would not need the inclined plane above described for pushing the studs upwards, and moreover all the supply-stations which supply components from above may be, and preferably are, in this case grouped around the assembling station.

Dated this 16th day of July, 1929.

For the Applicants:
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51/52, Chancery Lane, London, W.C. 2.

COMPLETE SPECIFICATION.

Improvements relating to Machines for Assembling Driving Chains.

We, HANS RENOLD LIMITED, a Company organised under the laws of Great Britain, and ALFRED RENSHAW, a British Subject, both of Burnage Works, Didsbury, Manchester, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to machines of the rotary type for assembling the elements of jointed transmission chains of the kind comprising link plates and cylindrical jointing members. The invention is equally applicable to the assembly of single-strand chains, duplex or triplex bush roller driving chains (that is, chains consisting of two or three sets of link plates mounted side by side on the studs) or inverted-tooth chains of the multiple-link type, or in fact to any chains in which link plates have to be assembled with cylindrical jointing members, which will hereinafter be referred to as studs.

According to the present invention the machine has a cyclically-moving holder (for example a rotating table), is provided with sockets for holding a number of studs in their proper spaced relation, and the other components of the chain are supplied to the studs while so held. Thus the studs themselves are employed as registering elements for the other components, with the result that the machine may be made much simpler than those hitherto proposed.

The holder for the studs is preferably a circular table rotating step-by-step and provided with notches in its edge for the studs, a stationary shroud-plate surround-

ing the table serving to retain the studs in the notches. It would be within the scope of the invention, however, to use other kinds of cyclically-moving holder, for example, a flexible or jointed conveyor moving in a horizontal plane.

A number of tool stations are spaced around the table, at each of which stations tools for effecting the different assembling operations are provided, these tools being conveniently carried by a vertically-reciprocating ram at each stroke of which an operation is completed at each station. At each station there is a feed slide which supplies the various components into the correct position for the operation of the tools.

A machine of this character having only one stud-holder cannot be used for assembling single-strand chain because a considerable proportion of the length of the studs must be held in the notches, with the result that when the inner combinations (each consisting of two bushes and two inner link-plates) are assembled with them the upper ends of the studs are inaccessible within the bushes and consequently the outer link-plates cannot be assembled with them. For the same reason a duplex or triplex chain cannot be completely assembled but has to be completed (by the addition of the outer link-plates to the lower ends of the studs) after it has left the machine. A further feature of the invention makes provision for enabling a single-strand chain to be assembled (partly or completely) or a duplex or triplex chain to be completely assembled, in a single machine. This further feature of the invention consists in a second holder to which the partly-assembled chain is automatically transferred from the stud-holder and which engages the bushes after the manner of the teeth of a sprocket-wheel and thus leaves the lower ends (or both ends) of the studs free for the assembly therewith of further chain components while the chain is supported on the second holder.

When a machine embodying this further feature of the invention is used for assembling single-strand chain, it is preferably provided with means for pushing the studs lengthwise, after they have left the stud-holder, so that their hitherto inaccessible ends project beyond the bushes of the inner combinations, a fixed inclined plane over which the lower ends of the studs ride being conveniently used for this purpose.

Another feature of the invention consists in devices for automatically omitting certain chain components at predetermined intervals in order to produce a succession of disconnected chains of definite length. The automatic omission of components is not new in itself but in the present case provision is made for omitting all the unwanted components so that chains are produced with no loose or unnecessary parts at their adjoining ends. According to this feature of the invention the operation of a counting device automatically causes two studs to be omitted by locking the stud-feeding device for one stroke, and at the stations supplying those other components which are not required at the adjoining ends of successive chains feeling mechanism is provided which detects the presence or absence of the studs at those stations and causes the feeding devices to be rendered inoperative for one stroke if the studs are absent.

Referring to the accompanying drawings,

Figure 1 is a diagram illustrating the operations performed by one machine according to this invention,

Figure 2 is a similar diagram illustrating the operations performed by a modified machine for assembling single-strand chain,

Figure 3 is a plan of a part of a machine according to Figure 1,

Figure 4 is a sectional elevation along the line IV—IV in Figure 3, with parts broken away,

Figure 5 is a fragmentary sectional elevation along the line V—V in Figure 3,

Figure 6 is a view similar to Figure 5 in section along the line VI—VI in Figure 3,

Figure 7 is a front elevation of the complete machine,

Figure 8 is a plan thereof,

Figure 9 is a side elevation as seen from the right of Figure 7,

Figure 10 is a diagrammatic perspective view further illustrating the modified form of the invention shown in Figure 2.

Figure 11 is a plan of the modified machine,

Figure 12 is a front elevation thereof, and

Figure 13 is a side elevation as seen from the right of Figure 12.

The mode of operation of a machine according to this invention is best understood from a consideration of the diagrammatic Figure 1, which shows a straight-line development of an assembly table 10 provided with sockets for studs 12 in the form of notches 14 in its edge. The table is supposed to be moving from left to right in a step-by-step manner, each step of movement being equal to twice the distance between adjacent notches. A stud-supporting base-plate 11 underlies the table.

At A two studs 12 are fed downwardly

into each successive pair of adjacent notches, with the result that every notch receives a stud. At B a pair of centre link plates 16 is forced down on to each successive pair of studs, at C an inner combination 18 is pushed on to each pair of studs (these pairs consisting of studs not already joined together by the plates 16) and finally at D an outer link plate 20 is pressed on to the ends of each of the pairs already joined by the plates 16. Evidently no further components can be assembled with the chain while the studs are held in the notches 14, and therefore the partly-assembled chain must be removed from the assembly table and the assembly completed elsewhere.

In the case of single-strand chain the notched table 10 alone is inadequate, owing to the restricted length of the studs. An appreciable proportion of the length of the studs must lie in the notches, otherwise the studs will not be securely held, and consequently when the inner combinations are pushed on to the studs the upper ends of the latter will not project beyond the inner combinations and it will be impossible to assemble the outer link-plates therewith. This difficulty is overcome by the modification shown in Figure 2, which is a diagram similar to Figure 1. In this modification the studs are inserted into notches 14 in a table 10 at A, as before, and inner combinations 18 are pushed over them at B. Soon after this operation the teeth 22 of a sprocket-wheel enter between the bushes of the inner combinations, which rest upon the table 10, and withdraw the studs from the notches 14 in a manner which will be explained later, the components being thereafter supported by the sprocket-wheel. The surface of the base-plate slopes upwardly as at 24 and then continues horizontally for some distance beneath the teeth of the sprocket-wheel at a higher level, as indicated at 26, actually at the level of the undersides of the inner combinations. The result of this is that the studs 12 will be pushed upwards by the sloping portion 24 and will be held by the high-level portion of the base-plate with their upper ends projecting well above the upper edges of the bushes. While in this position the studs receive the upper outer link plates 20 at C. The sprocket-wheel is of course rotated step-by-step in the same manner as the table 10. Beyond the point C the base-plate 11 has a gap 28 through which the lower outer link-plates 19 are supplied to the lower ends of the studs, as indicated by the letter D. A pressure-block 30 with a sloping entering edge 32 surmounts the gap. This pressure-block ensures that the studs shall project to the full extent downwards and takes the thrust of the tool which forces the link-plates 19 on to the studs. As shown, the high-level portion 26 of the base plate 11 slopes downwards for a short distance to the gap 28 to ensure that the studs shall not jam within the bushes as the upper link-plates 20 ride under the pressure-block 30. The chain is now completely assembled.

It will be apparent that an analogous arrangement could be made to assemble completely a duplex chain. In this case all the operations shown in Figure 1 would be completed on the notched table 10, and after transfer to the sprocket-wheel the lower inner combinations and the lower outer link plates would be supplied from below. As it is unnecessary to raise the studs (the upper link plates 20 having already been applied) the base-plate 11 need not be continued beneath the sprocket-wheel, except as a convenience for supporting the chain after it leaves the sprocket-wheel completely assembled. The inner combinations supplied from below are held up by small spring clips secured to the sprocket-wheel, the inner combinations snapping past these clips when they are threaded upwardly over the studs.

Figures 3 to 9 illustrate in detail a machine which performs the operations described above with reference to Figure 1. Referring first to Figures 3 and 4, the rotating assembly-table 10 with notches 14 for receiving the studs 12 is surrounded by a shroud plate 34 which serves to hold the studs in the notches as the table rotates. The shroud plate has a gap at 36, flanked by upstanding guides 38, for the passage of the partly-assembled chain leaving the assembly-table. The four assembly stations A, B, C and D for the supply and assembly respectively of studs 12, centre link plates 16, inner combinations 18 and outer link-plates 20, are spaced around the table leaving sufficient space between them to enable an attendant to apply by hand studs or inner combinations in case of failure of supply of these components. Each assembly station has a horizontally reciprocated feed slide and a vertically reciprocated punch. All the punches are carried by a tool-head 40 fixed to a ram 42 extending downwardly through the centre of the table and this ram is moved downwards (and the slides moved inwards) during each pause in the step-by-step movement of the table, in a manner which will presently be described.

Studs are fed at Station A through two parallel tubular chutes 44 which end

immediately above the nose of a feed-slide 46 arranged to slide radially and urged inwards towards the edge of the table 10 by springs 48 but normally held outwards by a bell-crank 50 and a cam-operated rod 52. The nose of the feed-slide is in three parts, a fixed central part 54 and two pivoted jaws 56 having tail-pieces urged apart by a spring 58. The spaces between the parts 54 and 56 are shaped to form pockets which are in line with the chutes when the slide is retracted. The tail-pieces are forced slightly together (thus spreading the jaws apart to enable the studs to enter the pockets from the chutes) by means of two fixed cams 60 which are encountered by the tail-pieces as the slide nears its retracted position.

When the slide is allowed to move forward, the two studs are brought immediately above two of the notches 14 in the table 10, the slide being arrested in this position by an adjustable stop 62. Meanwhile the ram 42 has been descending. Attached to the tool-head 40 is a punch 64 carrying two spring-pressed pins 66 which engage the studs and push them downwards into the notches 14, whereupon the slide 46 is retracted positively by the rod 52, the jaws 56 snapping past the pins 66. At the end of the return movement of the slide the jaws open slightly, two more studs enter from the chutes and the process is repeated.

When the ram has nearly reached the top of its travel the table 10 is moved to the extent of two notches, thus bringing an empty pair of notches into position to receive studs.

At Station B, centre link plates 16 are fed two at a time. A stack of these link-plates is housed in a magazine 68 and rests upon the nose of a slide 70 provided with a ledge of such a height that it removes two link-plates from the bottom of the stack when it moves forward under the action of springs 72. The nose of the slide is provided with two slots 74 which register with the notches 14 in the table. The tool-head carries a punch 76 in which are two spring-pressed pins 78 which enter the holes in the link plates 16 and the slots 74 when the slide reaches its innermost position (being arrested in that position by an adjustable stop 78A) and as soon as this occurs the slide is retracted positively by means of a bell-crank 80 and a cam-operated rod 82. The punch continues to descend, stripping the link-plates from the pins 78 and forcing them on to the studs. The pins meanwhile are pushed back into their housings in the punch by the studs and when the ram rises the pins bear down upon the studs, thus holding them in the notches 14.

At Station C, inner combinations 18 are fed along a chute 84 to a position in front of the nose of a slide 86, moved inwardly radially by springs 88 and retracted positively by a bell-crank 90 and a cam-operated rod 92. The nose of the slide, when in the retracted position, is a continuation of the outer wall of the chute 84, and a forward extension 94 of the slide provides a stop for the foremost of the inner combinations. This inner combination is clamped against the nose of the slide by a jaw 96 formed on the end of a lever 98 pivoted to the slide and held in the clamping position by a tension spring 100. An adjustable stop 102 limits the movement of the lever in the direction in which it is moved by the spring, and the jaw 96 is rounded as shown to enable the inner combinations to enter between it and the nose of the slide, stretching the spring 100 slightly in so doing.

The slide 86 advances during the early part of the downward movement of the ram. The tool head carries a punch 104 in which are two spring-pressed pins 106 which enter the bushes of the inner combination. As soon as this occurs, the slide 86 is retracted, the jaw 96 snapping past the inner combination against the action of the spring 100, and the punch continuing its descent pushes the inner combination down on to the studs, or rather ensures that it falls down to its proper position, for the bushes are a comparatively loose fit on the studs and in most cases they will fall over the studs by their own weight.

At Station D (see also Figure 6) the arrangements are quite similar to those at Station B, with the exception that the ledge on the nose of the slide 108 is of a height to feed only one outer link-plate 20 from the stack in the magazine 110, and that the punch 112 is set at the higher level appropriate for forcing the link plates on to the reduced-diameter upper ends of the studs. The slide is moved forward by springs 114 and retracted positively by a lever 116 and a cam-operated rod 118.

The machine is provided with means, now to be described, for automatically omitting certain components at predetermined intervals, for the purpose of producing a succession of disconnected chains all of the same length. In British Patent Specification No. 295,439 a mechanism is described for omitting an outer link plate at intervals on one side of the chain, thereby enabling the remainder of the "outer combination" (consisting of the link plate on the other side and two studs)

to be removed by hand and thus producing an interruption in what would otherwise be a chain of indefinite length. This mechanism comprised a pattern chain, to which a cam-plate was attached, which was hung round a sprocket-wheel rotated step-by-step in time with the cyclical operation of the machine, the cam-plate rocking a lever which caused the outer link-plate feed-slide to be locked for one cycle. A similar pattern chain is used in the present machine but the cam-plate attached thereto causes the stud feed-slide 46 to be locked for one cycle, thus omitting two studs. For this purpose a locking lever 120 (Figure 3) is employed which is pivoted at 121 to a fixed part of the machine. Normally the outer or rear end of this lever is held down by the weight of the lever out of the path of a lateral extension 123 of the feed slide, but is raised by the cam plate on the pattern chain (by a connection not shown) so as to lock the feed slide from moving inwards during one machine cycle.

The omission of the two studs would in itself interrupt the continuity of the chain, but there would then be an unnecessary and undesirable feeding of centre link-plates and outer link-plates. Means are however provided whereby the absence of a pair of studs automatically brings about the locking of the feed slides 70 and 108 (which feed centre link plates and outer link plates respectively) during the cycles in which there are no studs present at Stations B and D. Referring to Figure 3, a lever 124 similar to the lever 120 is pivoted at 125 to a fixed part of the machine and its front end is extended to a position close to the pair of notches 14 adjacent the slide 70 on the side thereof from which the studs approach it and with its upper surface normally at about the level of the upper ends of the studs. The punch 76 carries two additional spring-pressed pins 126 the lower ends of which are so situated, and of such a size, that they overly both the two studs and the edge of the front end of the lever. It will be appreciated that if studs are present in the two notches 14 the pins will be prevented from pressing down the front end of the lever, but that if the studs are absent the pins will depress the front end of the lever during the final part of the downward movement of the ram, thus causing the rear end 127 of the lever to be raised into the path of an extension 128 of the slide 70. At this time the slide is at the extreme outward limit of its travel, having just returned from a forward feeding movement, and the rear end of the lever is spaced slightly away from the edge of the extension 128, as clearly shown in Figure 3. The cam which operates the slide 70 is however so shaped that it allows the slide to advance, when the ram reaches its lowest point, a distance slightly greater than the gap between the rear end of the lever and the extension 128, this slightly advanced position being maintained unchanged until the next forward feeding movement. If the lever 124 has not been rocked, consequent on the presence of studs beneath the pins 126, the next feeding movement takes place normally, but if the studs are absent the rear end 127 of the lever is raised at the time that the slight advance movement of the slide takes place, with the result that the edge of the extension 128 will be pressed by the springs 72 against the rear end of the lever, thus holding the lever in the raised position. The lever will consequently hold the slide back during the time that it would otherwise make the next feeding movement. Immediately afterwards, however, the cam withdraws the slide to its full extent, thus allowing the lever to drop to its normal position. It will, of course, be appreciated that the table 10 will have moved one step in the meantime to bring the empty notches 14 opposite the feed slide, where they remain during the suppressed feeding movement. The result is that no centre link-plates are fed when there are no studs to receive them.

Precisely similar mechanism is provided at Station D, the lever being indicated at 130 and the additional spring-pressed pins at 132. The cam which operates the slide 108 has the same contour as that which operates the slide 70.

The mechanism just described has the further advantages that on starting up the machine no link plates are fed until the first pair of studs reaches the stud-feeding stations. Inner combinations are, however, supplied (unless the attendant locks the slide 86 manually until the first stud arrives at Station C) but this is immaterial—the unwanted inner combinations are simply pushed round and delivered at 36, where they are returned by hand to the hopper.

Referring now to Figures 7, 8 and 9, the ram 42 is reciprocated vertically by a crank 200 through a connecting-rod 202, and its weight is supported by springs 203. The crank-shaft 204 carries a gear-wheel 206 meshing with a pinion 208 carried by a countershaft 210 which is driven through a chain 212 from an electric motor 214. The crank-shaft 204 drives a countershaft 216 by means of a chain 218 and this countershaft drives a cam-shaft 220 through bevel gearing 222.

On the cam-shaft are four cams 224 each operating a rocker 226, each of which operates one of the rods 52, 82, 92 and 118 which retract the slides 46, 70, 86 and 108 as previously described.

Inner combinations 18 are supplied through the chute 84 from a hopper 228 which is similar to the hopper 76 described in our British Patent Specification No. 295,439 and therefore needs no detailed description. Studs are supplied to the chutes 44 from a hopper 230 similar to that described in British Patent Specification No. 326,604, but with its feeding parts duplicated.

The magazines 68 and 110 are filled by hand from pairs of wires on which the link plates are strung. These wires may have the plates strung on them in another machine, or by hand, but it is preferred to perform the stringing operation by means of attachments to the machine itself. These attachments are indicated at the sides of the machine. That for the centre link plates comprises a hopper 232 feeding link-plates down a chute 234 to a point 236, where they are threaded on the wires by a stacker actuated by a face cam 238. The outer link-plates are fed from a similar hopper 240 and chute 242 and threaded by a stacker actuated by a cam 244. These arrangements need not be described in detail as they are fully disclosed in British Patent Specification No. 295,439. The chute 242 is provided with an arrangement fully described in the specification last mentioned, for ensuring that all the link-plates fed to the stacker have their bevelled edges presented the same way, those oppositely presented being rejected into a tray 246. This arrangement is unnecessary in the case of the chute 234 because the centre link plates are not bevelled.

The pattern chain previously referred to is indicated at 247, the sprocket 248 which supports it being rotated step-by-step by means of a ratchet and pawl mechanism operated by an adjustable-throw crank 249. No detailed description of this mechanism need be given as it is fully described in the patent specification last mentioned.

To finish the chain it is necessary to supply inner combinations, and finally the outer link plates to the other ends of the studs. This is done preferably on a machine of the rotary type. Such a machine may resemble the machine described above except that the table 10 is replaced by a sprocket wheel, surrounded of course by a shroud plate, and that there are only two supply and assembly stations, similar in all respects to Stations C and D above described. Similar arrangements for suppressing the feed of outer link-plates except when studs are present are also used.

Figure 10 is a perspective diagrammatic view further illustrating the modified form of the invention already explained to some extent with reference to Figure 2. The table 10 with notches 14 in its edge, and surrounded by the shroud-plate 34, will need no further description as it is similar to that shown in Figures 3 and 4. The sprocket-wheel 23, provided with a shroud-plate 36, is geared to the table so as to rotate to the extent of two teeth at each step of movement of the table, and its teeth 22 overly the edge of the table to an extent sufficient to enable the teeth to enter between the bushes of the inner combinations and guide them on to the inner edge of the shroud-plate 36 through a gap (not visible in Figure 10) in the shroud-plate 34.

Figures 11, 12 and 13 show the main outlines of the modified machine, it being understood that the detail arrangements are similar to those already described with reference to Figures 3 to 9 and that corresponding parts have the same reference numerals. There is of course no slide 70, and the additional slide for feeding lower outer link plates is designated 71. It is in all respects similar to the slide 108.

Three rams 250, 252 and 254 are employed. The rams 250 and 252 extend through the table 10 and the sprocket-wheel 23 respectively and the third ram 254 is wholly beneath the sprocket-wheel at Station D. The ram 250 is carried by a bracket 256 attached to the principal ram 252 and carries punches for applying the studs 12 and the inner combinations 18, while the ram 252 carries the punch for applying the upper outer link-plates 20. These two rams are operated through a lever 258 by a cam 260. A similar cam 261 operates the third ram (which carries the punch for applying the lower outer link-plates) through a lever 262. The cams 260 and 261 are identical but are displaced angularly in relation to one another to such an extent that the ram 254 moves oppositely to the rams 250 and 252—that is to say, they are 180° out of phase.

The table 10 and the sprocket-wheel 23 each carries a gear-wheel 264, 266 respectively which are geared together by means of a pair of idlers 268. The table 10 also carries a drum 270 surrounded by a clutch member consisting of two parts 272, 274 pivoted together at 276 and urged together at their free ends by a spring (not shown). The free end of the parts 272 is connected by a link 278 to a lever 280 rocked by a

groove-cam 282 on the shaft 284 which carries the cam 260. As the two clutch members maintain a continuous frictional grip on the drum, it will be appreciated that any movement to the right of the connecting rod 278 will move the table in a clockwise direction, whilst on its movement to the left a return movement of the table will be prevented by the spring-pressed pawl 288 engaging the ratchet wheel 286 carried by the table. Thus the table is caused to rotate step-by-step in a clockwise direction in time with the reciprocation of the rams. Mechanism similar to that described in connection with Figure 3 is provided for locking the slides 71 and 108 when there are no studs present at these stations.

It should be explained that the table 10 in the machine illustrated in Figures 3 to 9 is rotated by mechanism similar to that just described, but this mechanism has been omitted from Figures 7, 8 and 9 for the sake of clearness. The cam which corresponds to the cam 282 is marked 290 in Figure 9.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A machine for assembling jointed transmission chains comprising a cyclically-moving holder (for example a rotating table) having sockets for holding a number of studs in their proper spaced relation in combination with devices for supplying other components of the chain to the studs while the studs are held in the sockets.

2. A machine according to Claim 1 wherein the stud-holder is a circular table rotated step-by-step and provided with spaced notches in its edge for the studs and surrounded (or partly surrounded) by a stationary shroud-plate serving to retain the studs in the notches.

3. A machine according to Claim 2 which includes a number of feed slides adapted to feed the components of the chain, said feed-slides being spaced around the table, and a vertically-reciprocated ram carrying assembling tools which at each stroke complete the assembling operations simultaneously at the places to which the components are fed.

4. A machine according to Claim 2 further comprising a second holder to which the partly-assembled chain is transferred from the stud-holder and which engages the bushes of the chain after the manner of a sprocket-wheel, thereby leaving the lower ends (or both ends) of the studs free for the assembly therewith of further chain components while the chain is supported on the second holder.

5. A machine according to Claim 4, especially adapted for assembling single-strand chain, provided with means for pushing the studs lengthwise, after they have left the stud-holder, so that their hitherto inaccessible ends project beyond the bushes which were supplied to them while held in the stud-holder, said means preferably comprising a fixed inclined plane beneath the periphery of the second holder, over which the lower ends of the studs ride as they are carried round by the rotation of the holder.

6. A machine according to claim 4 or claim 5 wherein one or more of the feed-slides and assembling tools are situated below the second holder and supply chain components upwardly thereto.

7. A machine according to any one of the preceding claims provided with feeler mechanism adjacent the device or devices which supply components not required at the ends of chains, said feeler mechanism being arranged to detect the presence or absence of studs in each successive pair of sockets and to cause the said device or devices to be rendered inoperative for one stroke if the studs are absent.

8. A machine according to claim 7 in combination with means for automatically omitting a pair of studs from the holder at predetermined intervals.

9. A machine according to claim 7 or claim 8 wherein the said devices consist of feed-slides moved forward by means of a spring to feed the components (for example outer link-plates) and retracted positively, and wherein the feeling mechanism comprises a pivoted locking lever (for example 124) arranged to be encountered by a part of the feed-slide when rocked to an operative position but normally held by gravity in the inoperative position, and a resilient-mounted plunger (or more than one) overlying both a pair of stud-holding sockets and one end of the locking lever and arranged to be depressed at each machine cycle and to encounter the locking lever and rock it to its operative position only if it does not encounter a stud or studs, means beng provided for maintaining the lever in its operative or locking position during the time that the feed-slide would otherwise feed a component to the vacant part of the holder.

10. A machine according to claim 9 wherein the positive slide-retracting means is arranged to permit the slide to move forward after each retraction by an amount sufficient to enable it to engage the locking lever, if it is in the operative position, and to remain in engage-

ment therewith until the next retractive movement, whereby the slide itself and its spring serve as means for holding the locking lever in operative or locking position as aforesaid.

11. A chain-assembling machine constructed and operating in the manner described with reference to Figure 1 of the accompanying drawings.

12. A chain assembling machine constructed and operating in the manner described with reference to Figures 2 and 10 of the accompanying drawings.

13. The chain-assembling machine substantially as described with reference to Figures 3 to 9 of the accompanying drawings.

14. The chain-assembling machine substantially as described with reference to Figures 11, 12 and 13 of the accompanying drawings.

Dated this 24th day of March, 1930.

For the Applicants:
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51/52, Chancery Lane, London, W.C. 2.

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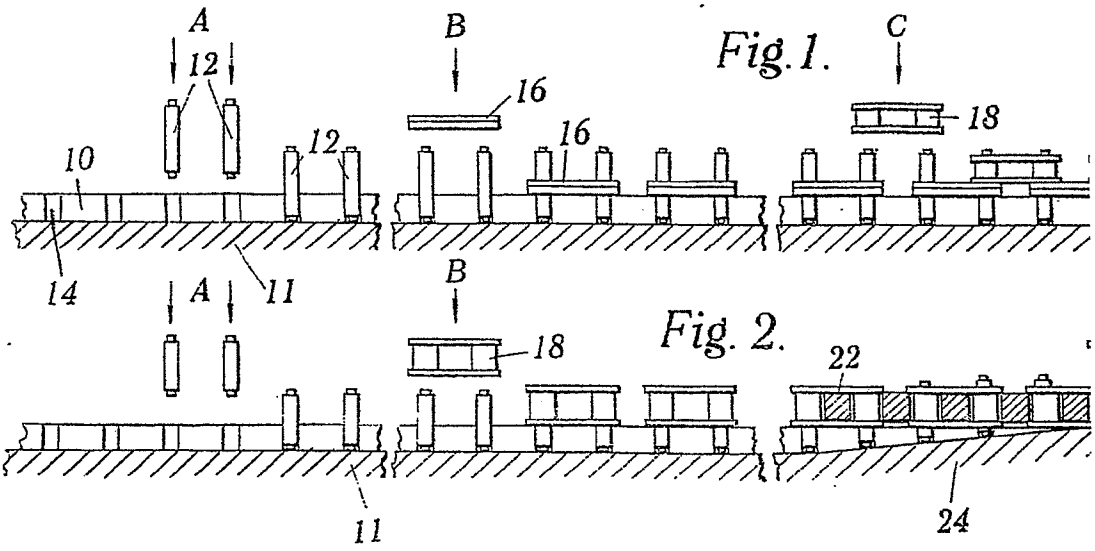
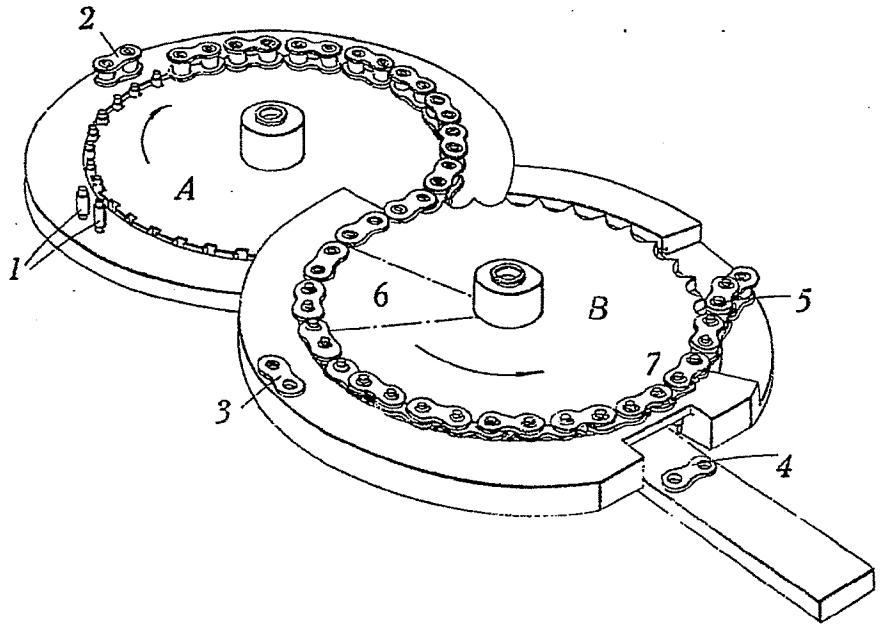


Fig. 1.

Fig. 2.

Fig. 10.



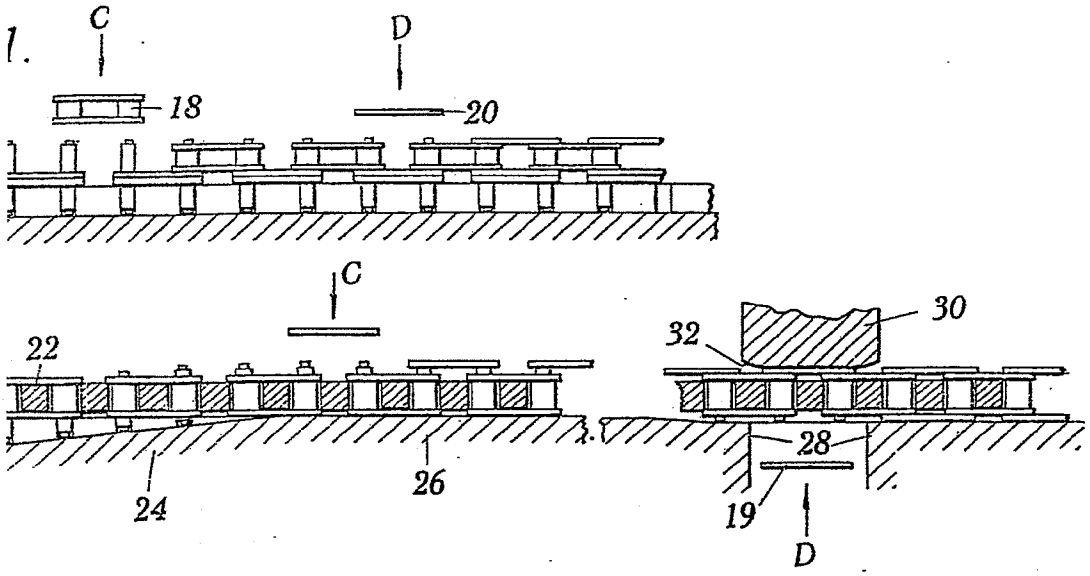

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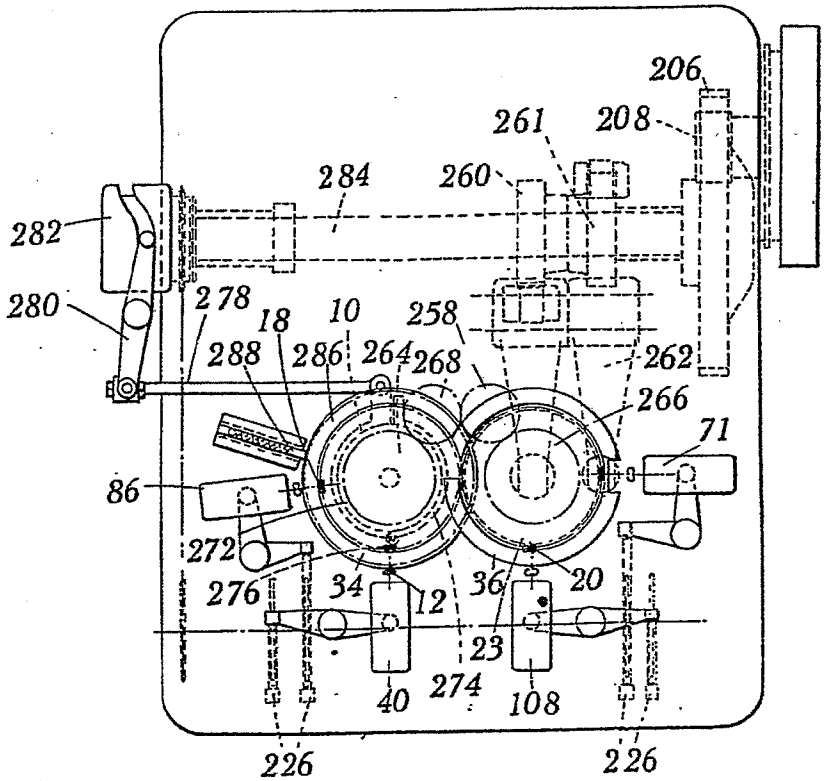
Fig. 11.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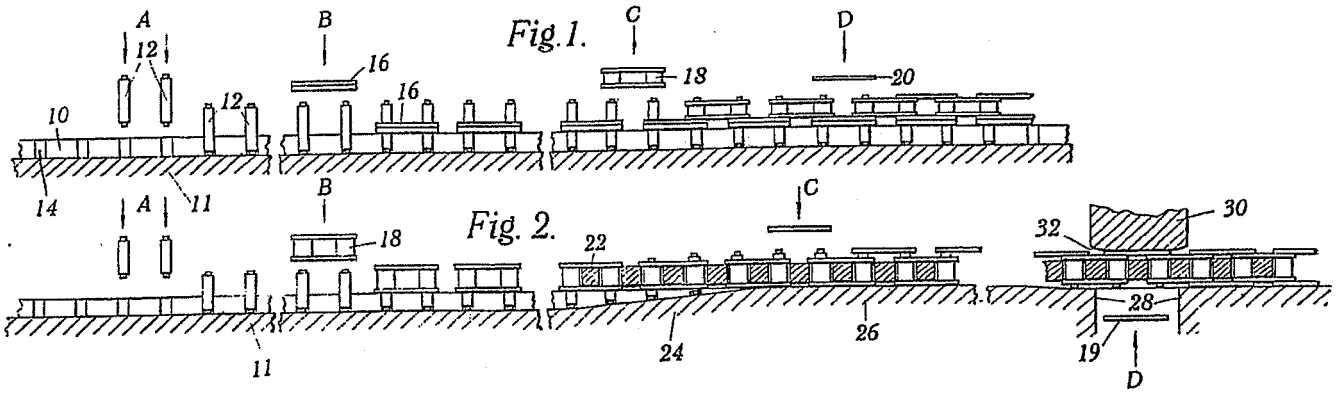


Fig. 1.

Fig. 2.

Fig. 10.

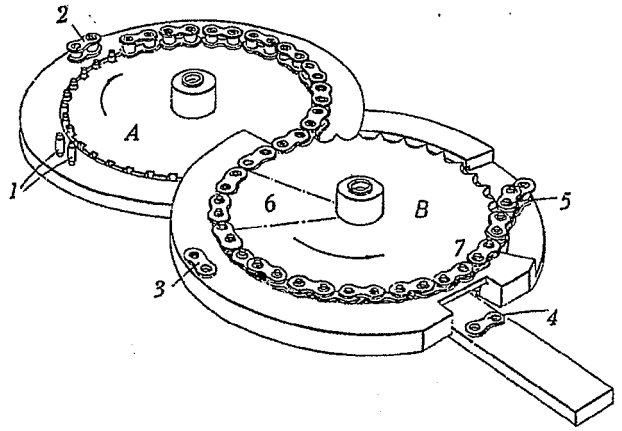
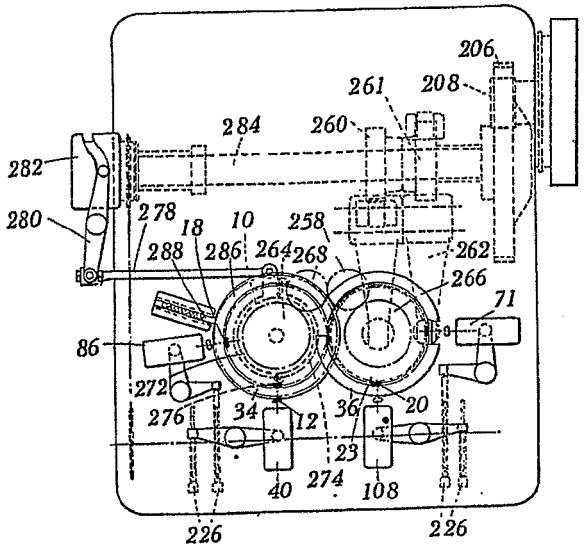


Fig. 11.



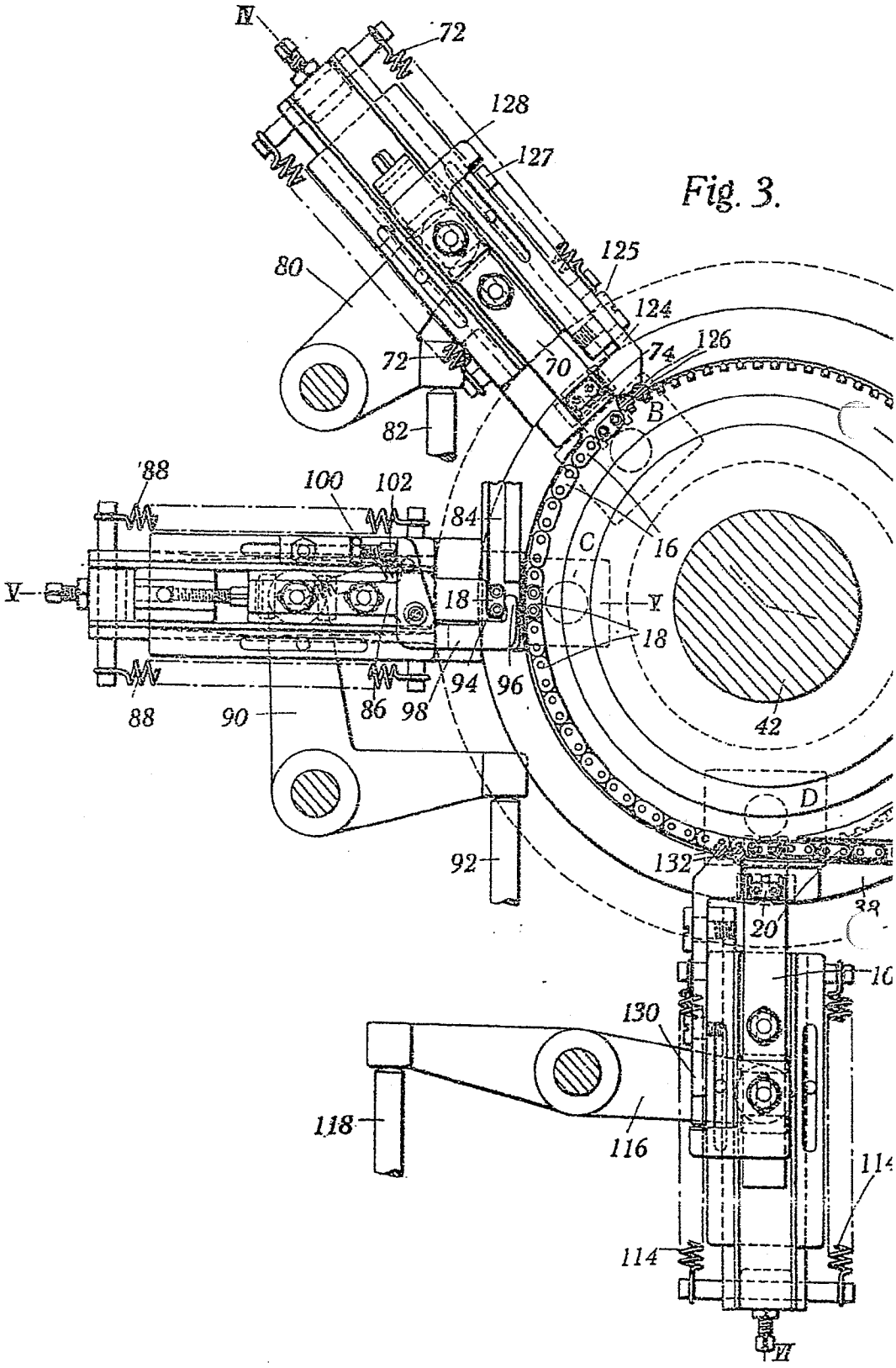


Fig. 3.

Fig. 3.

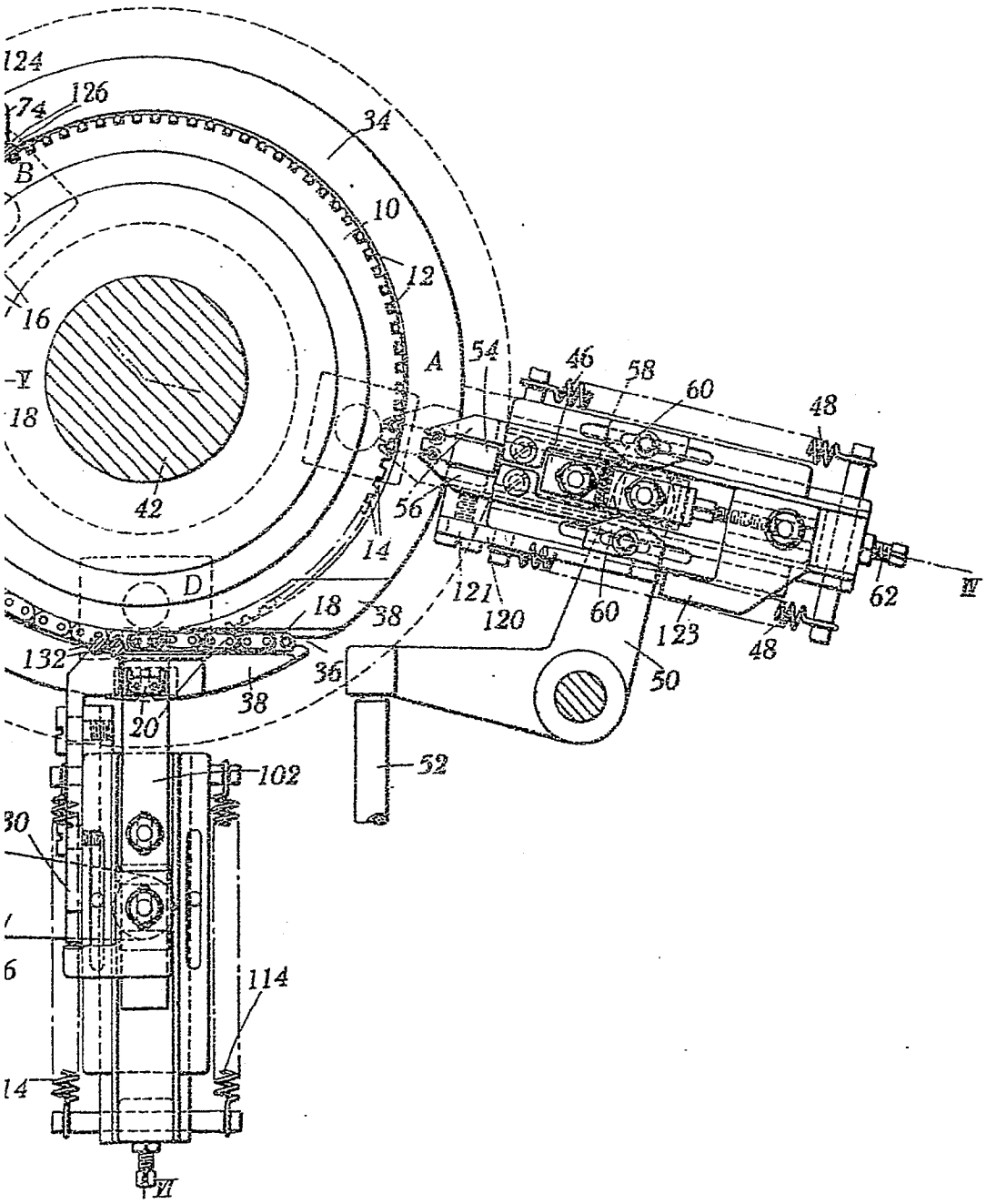


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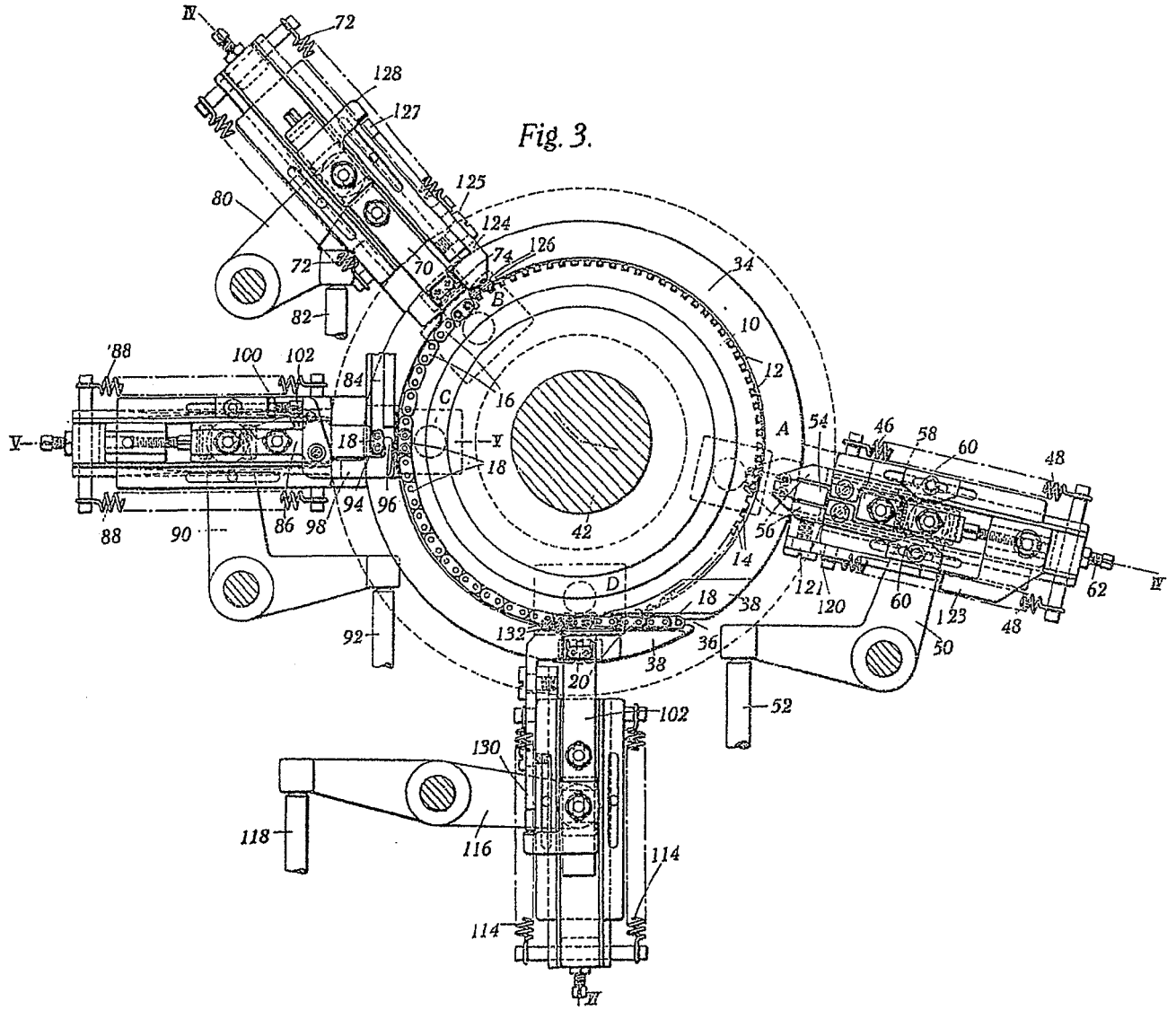
Fig. 3.



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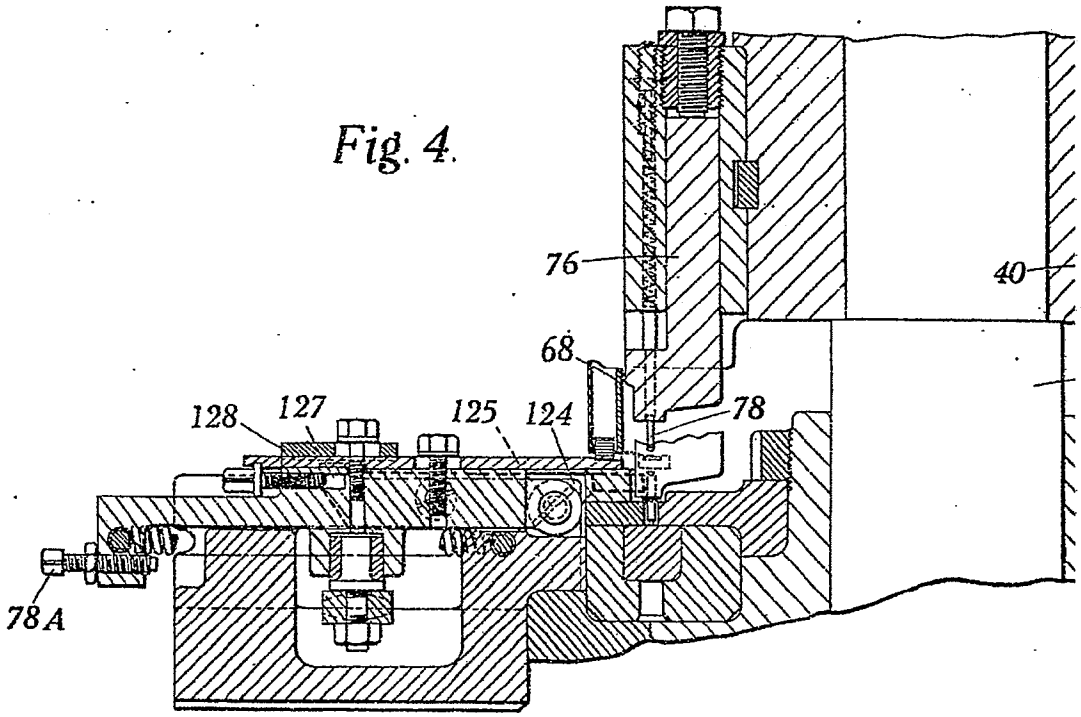

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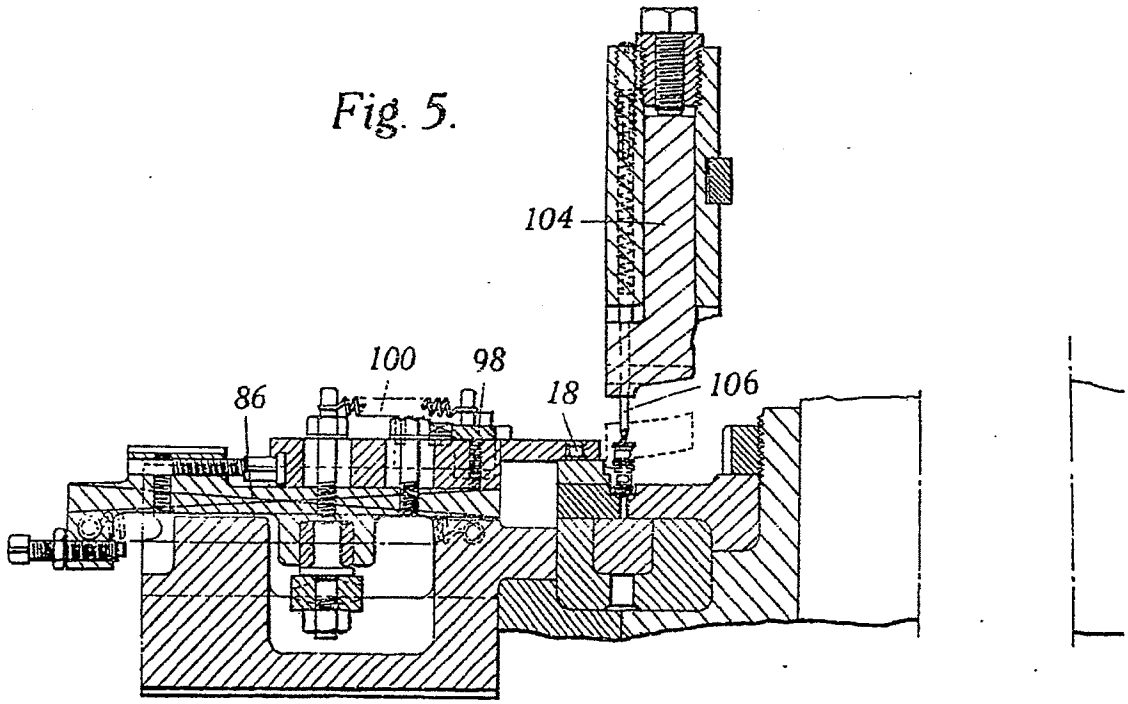

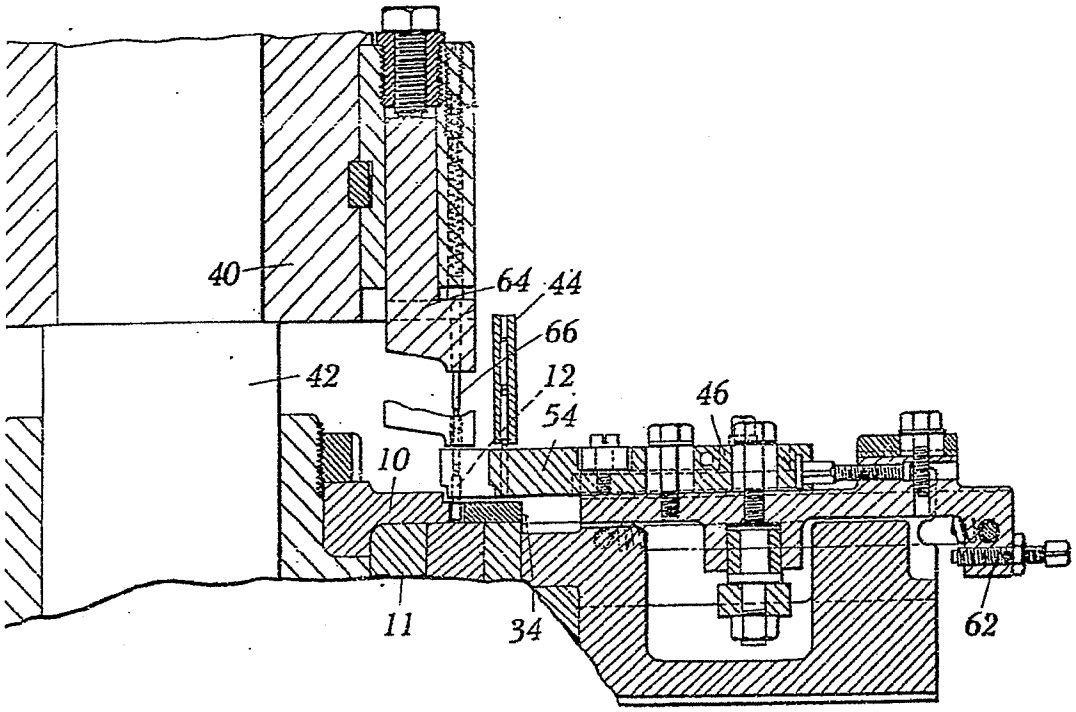

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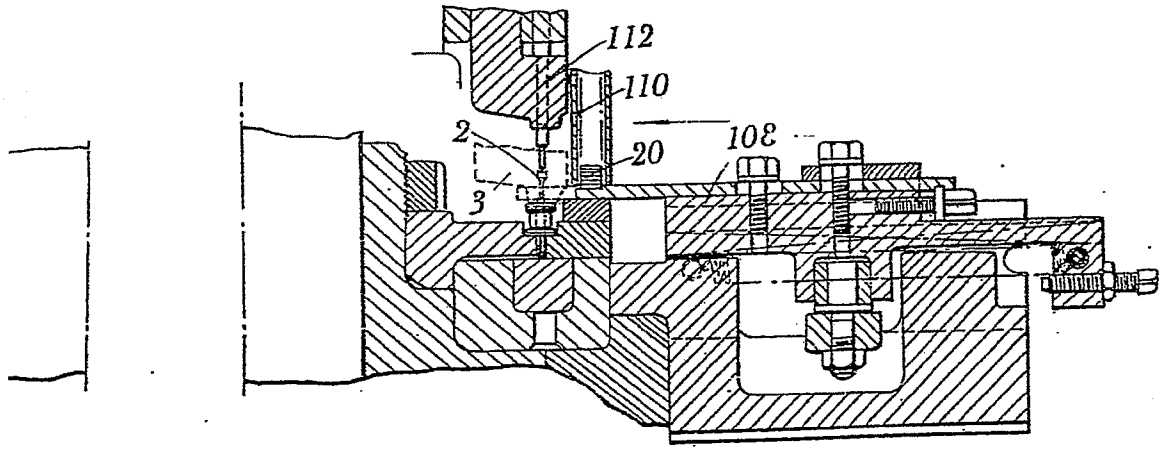

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Fig. 4.

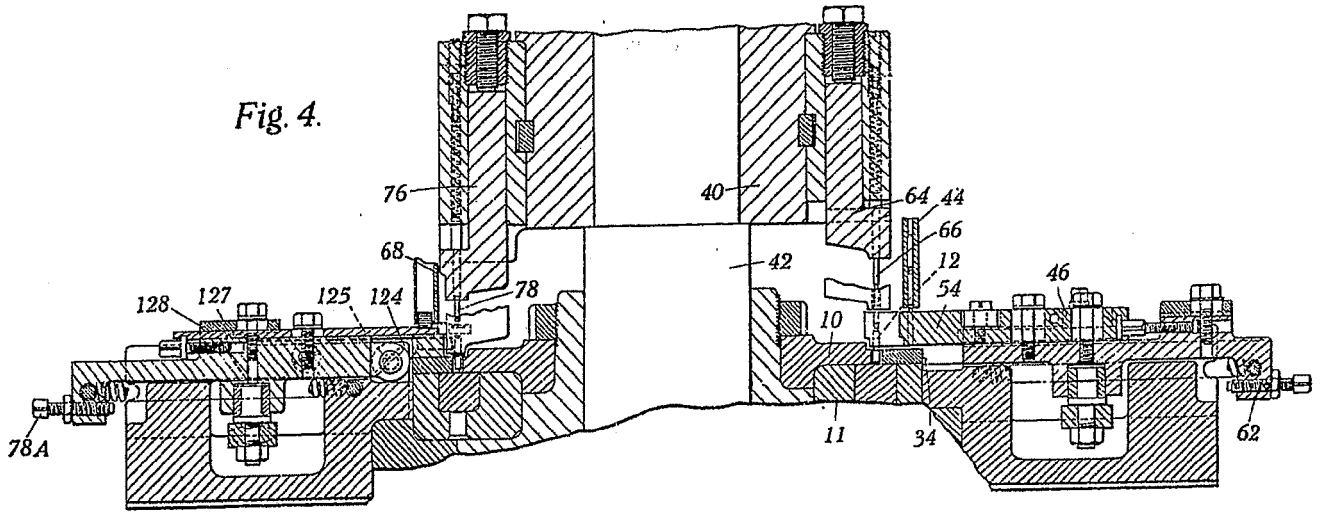
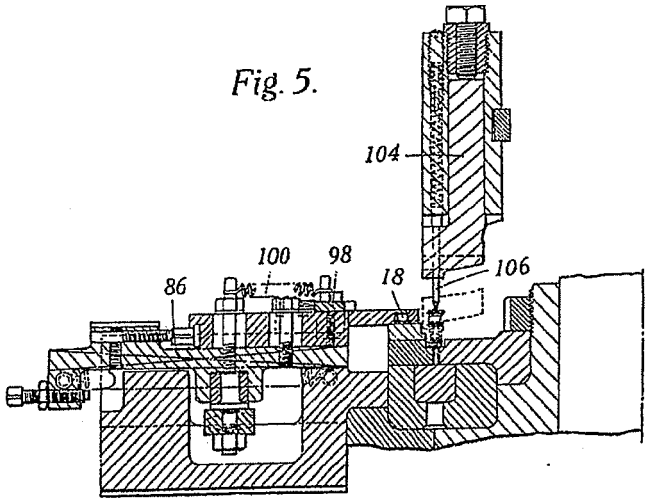


Fig. 5.



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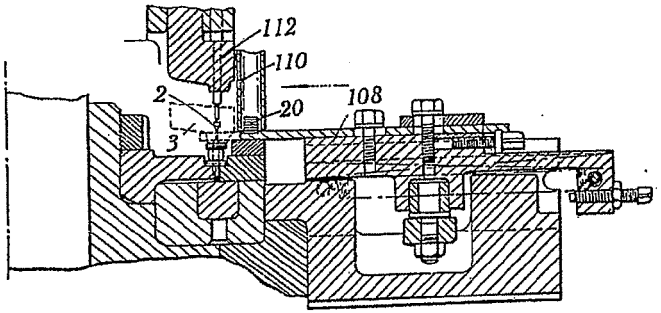

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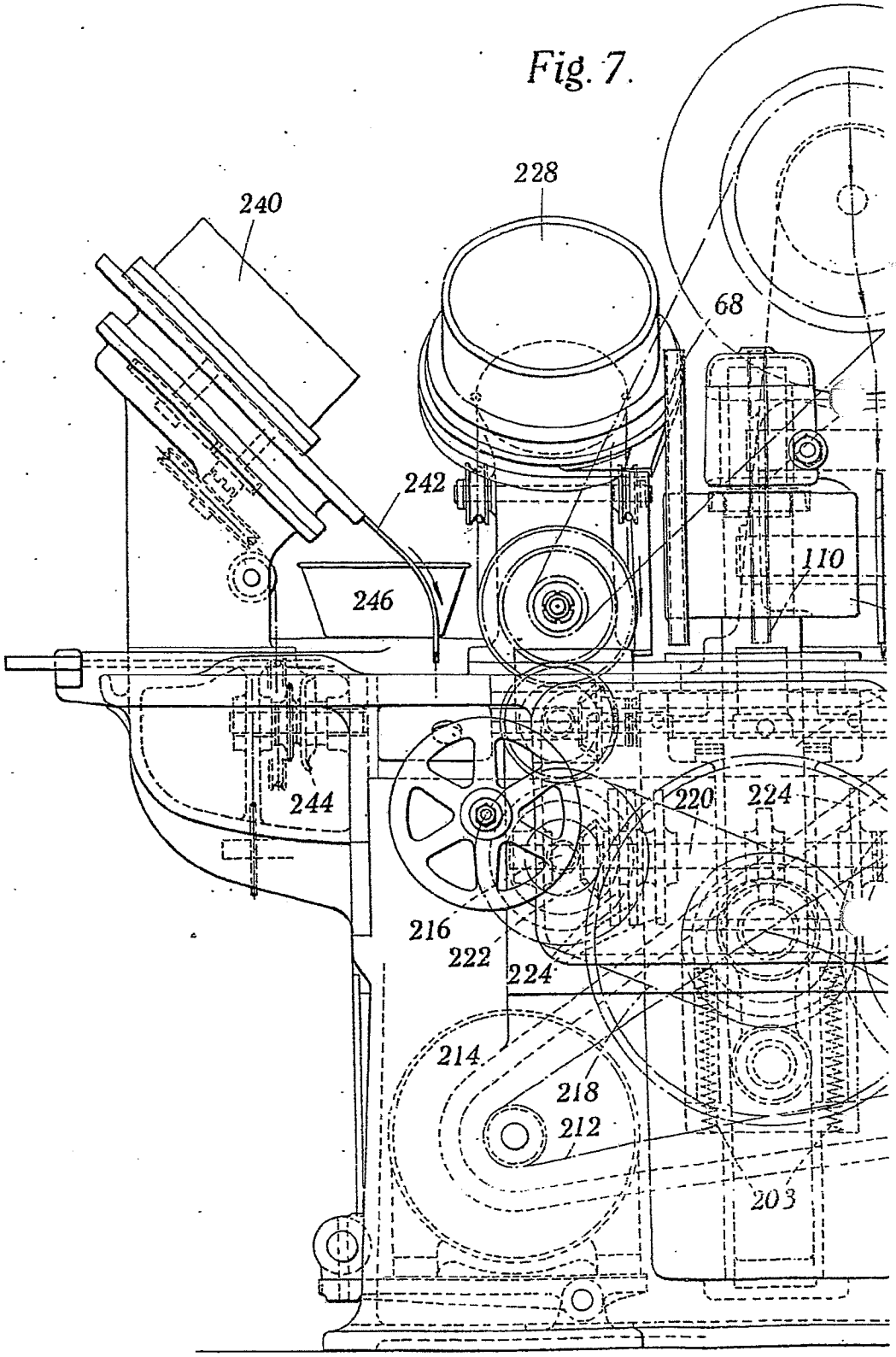

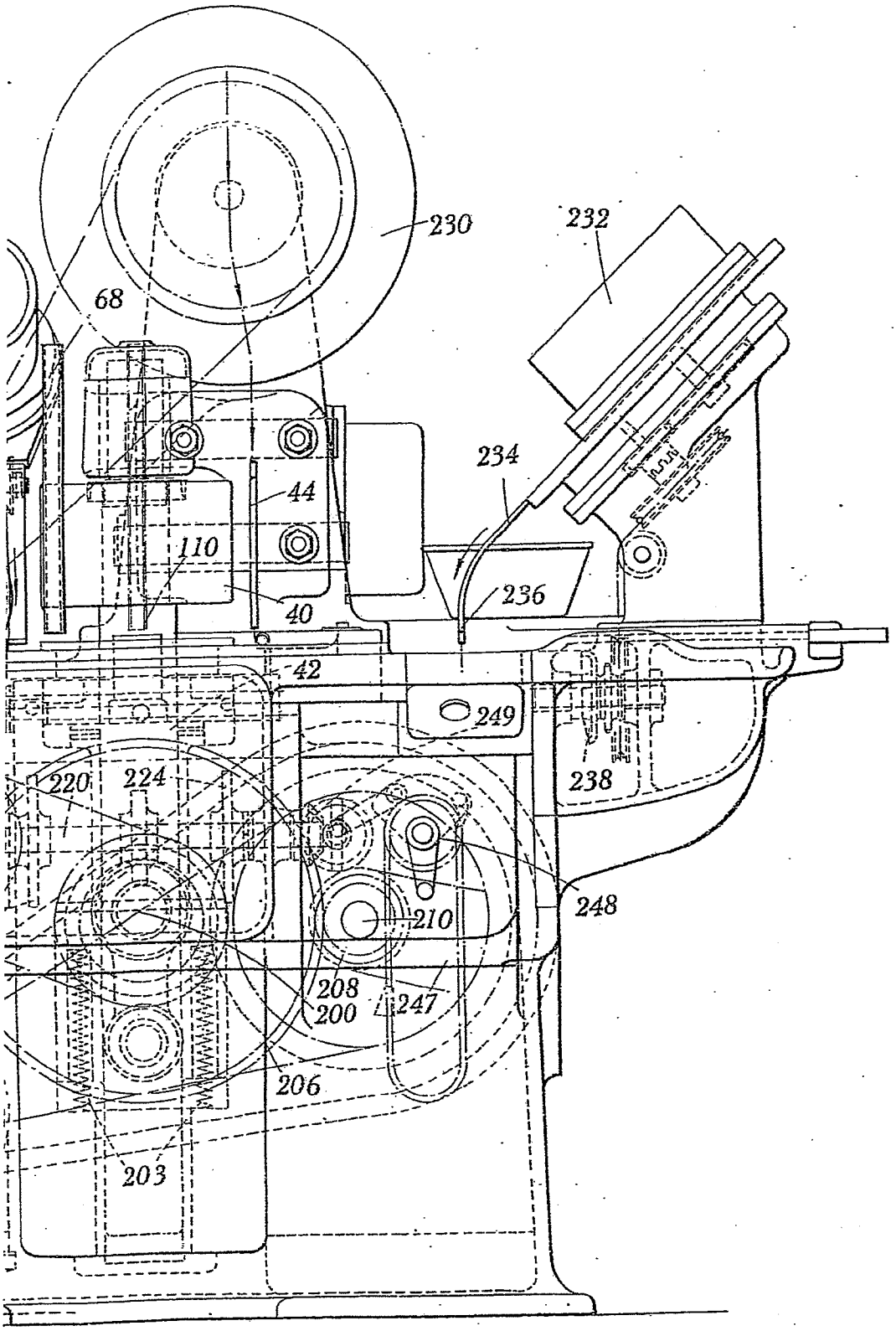

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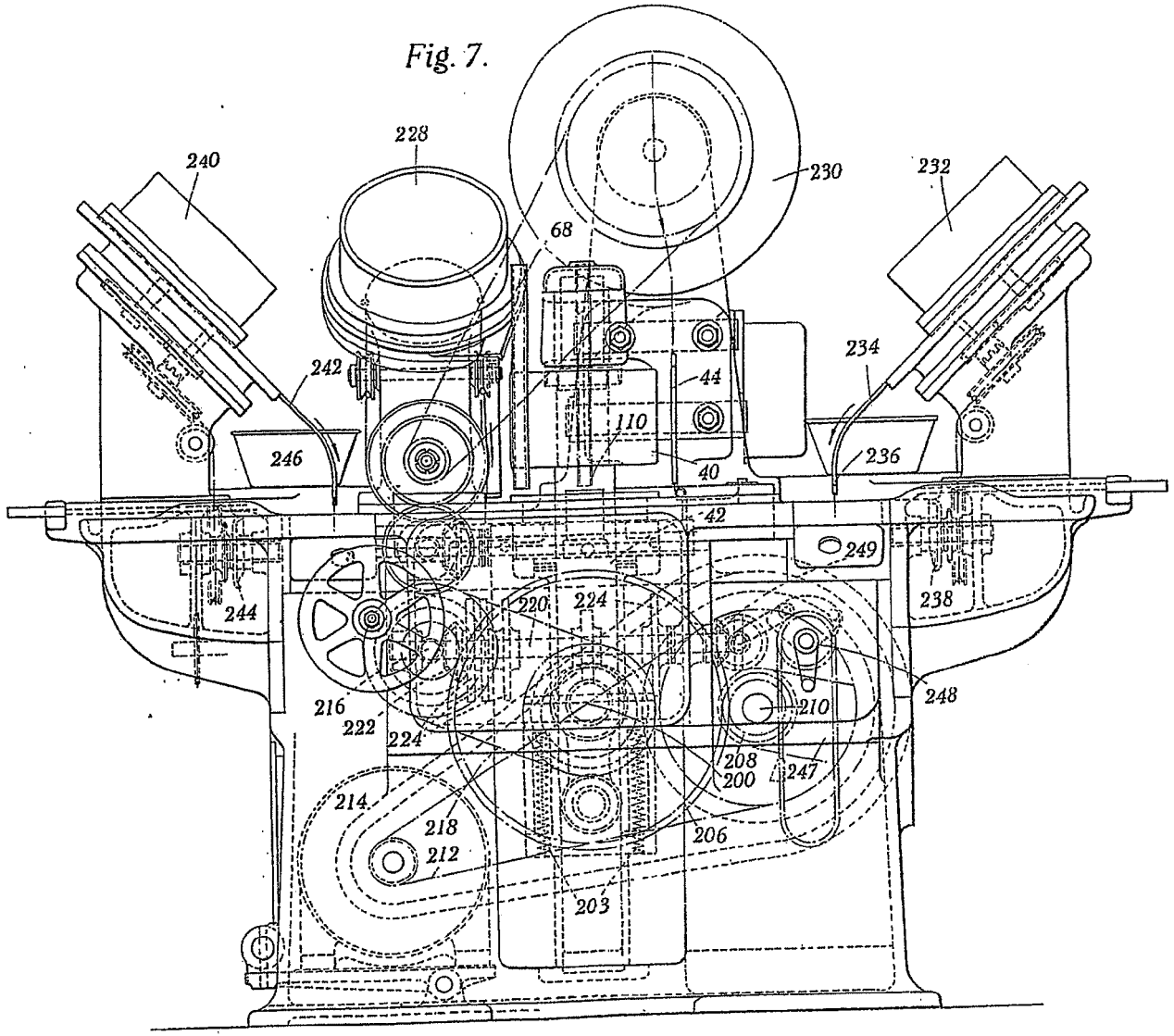

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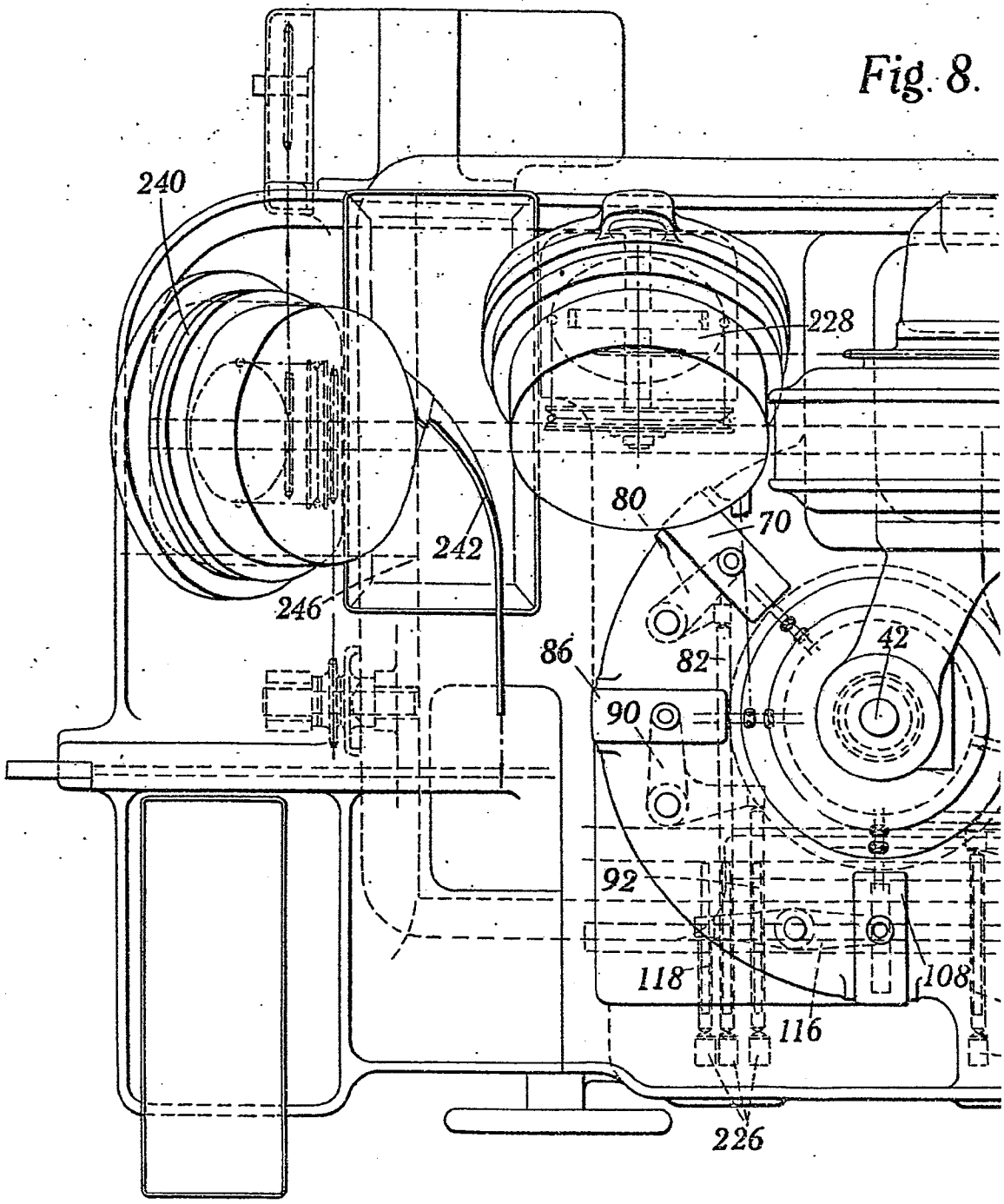

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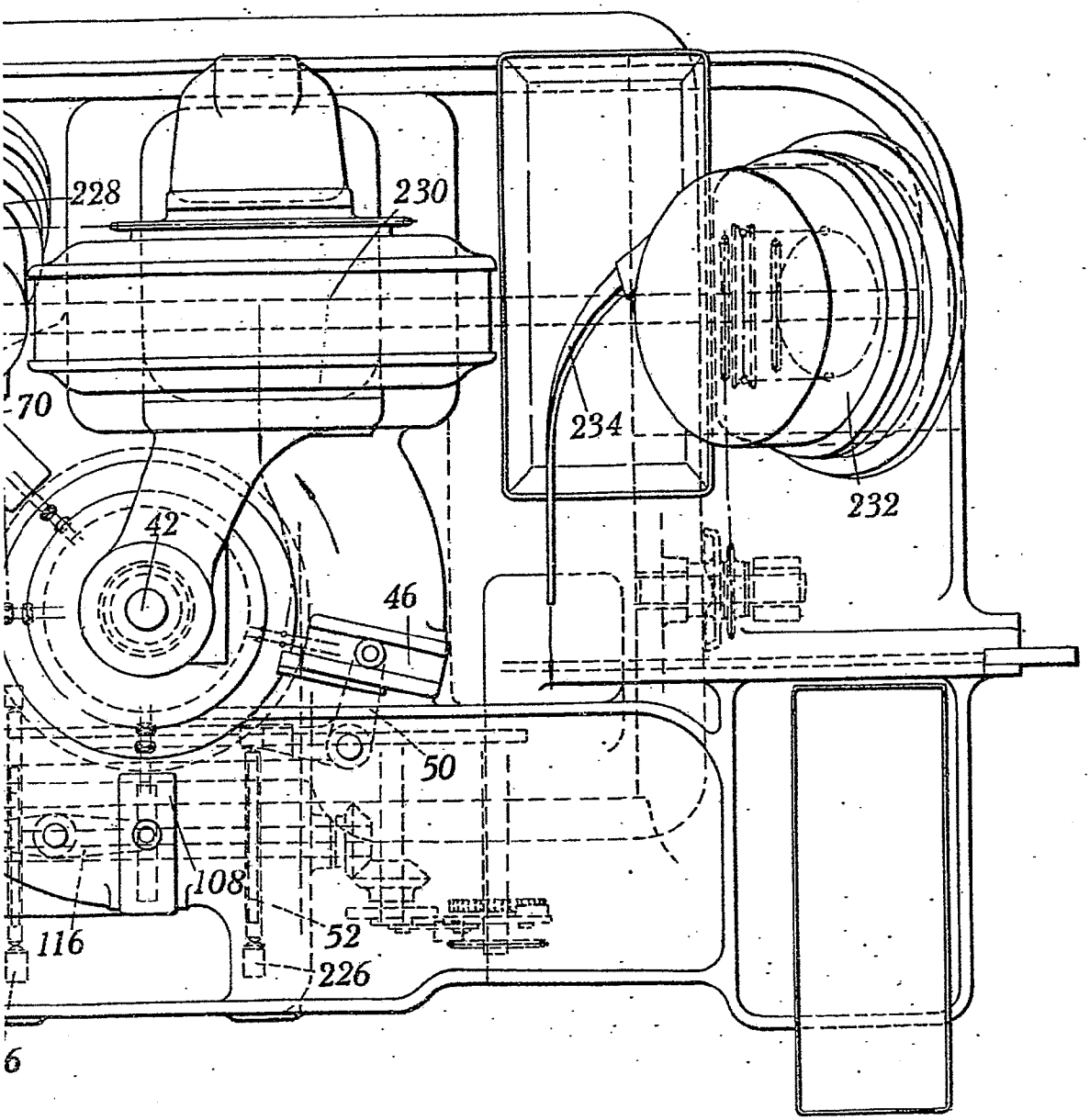

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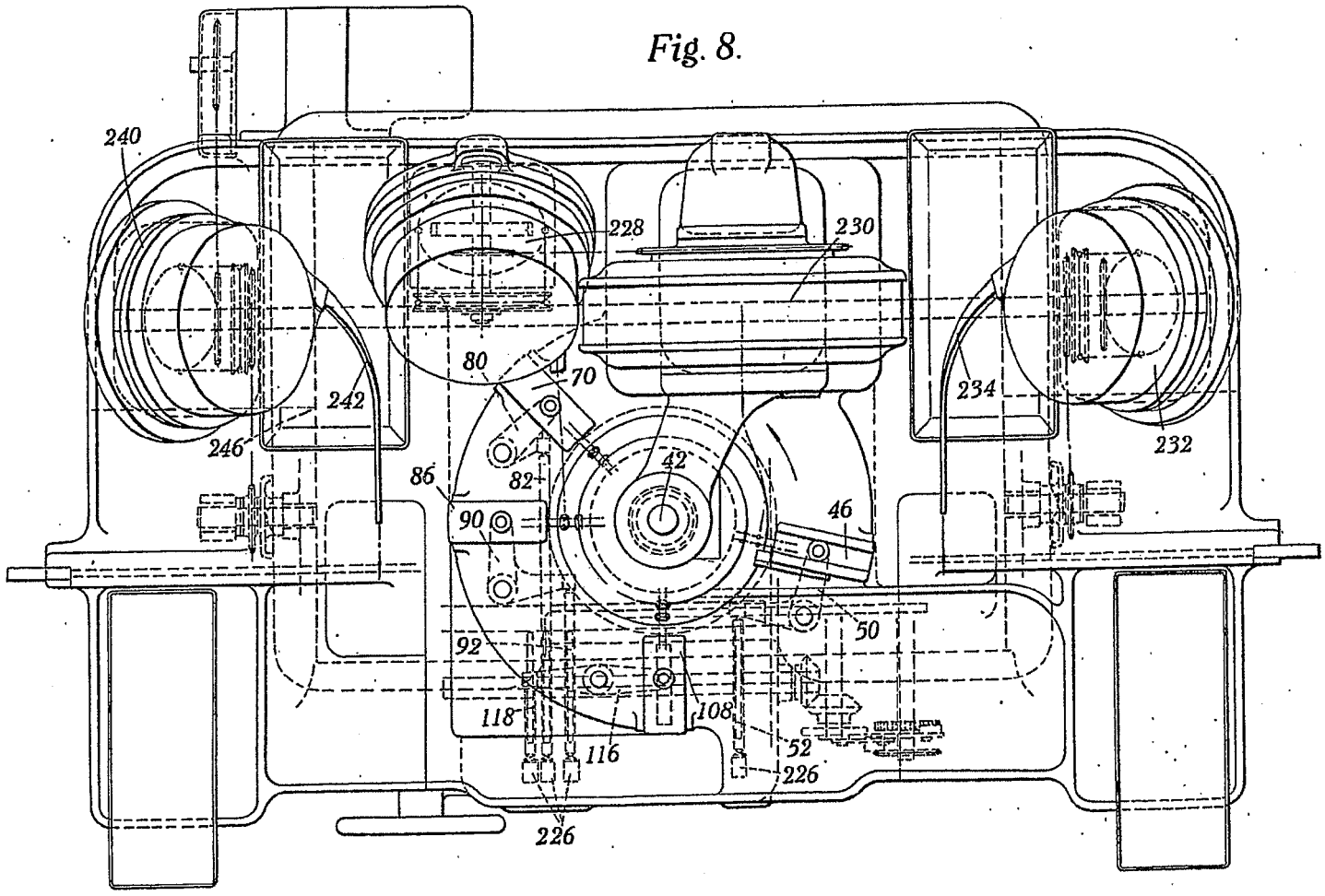
Fig. 8.



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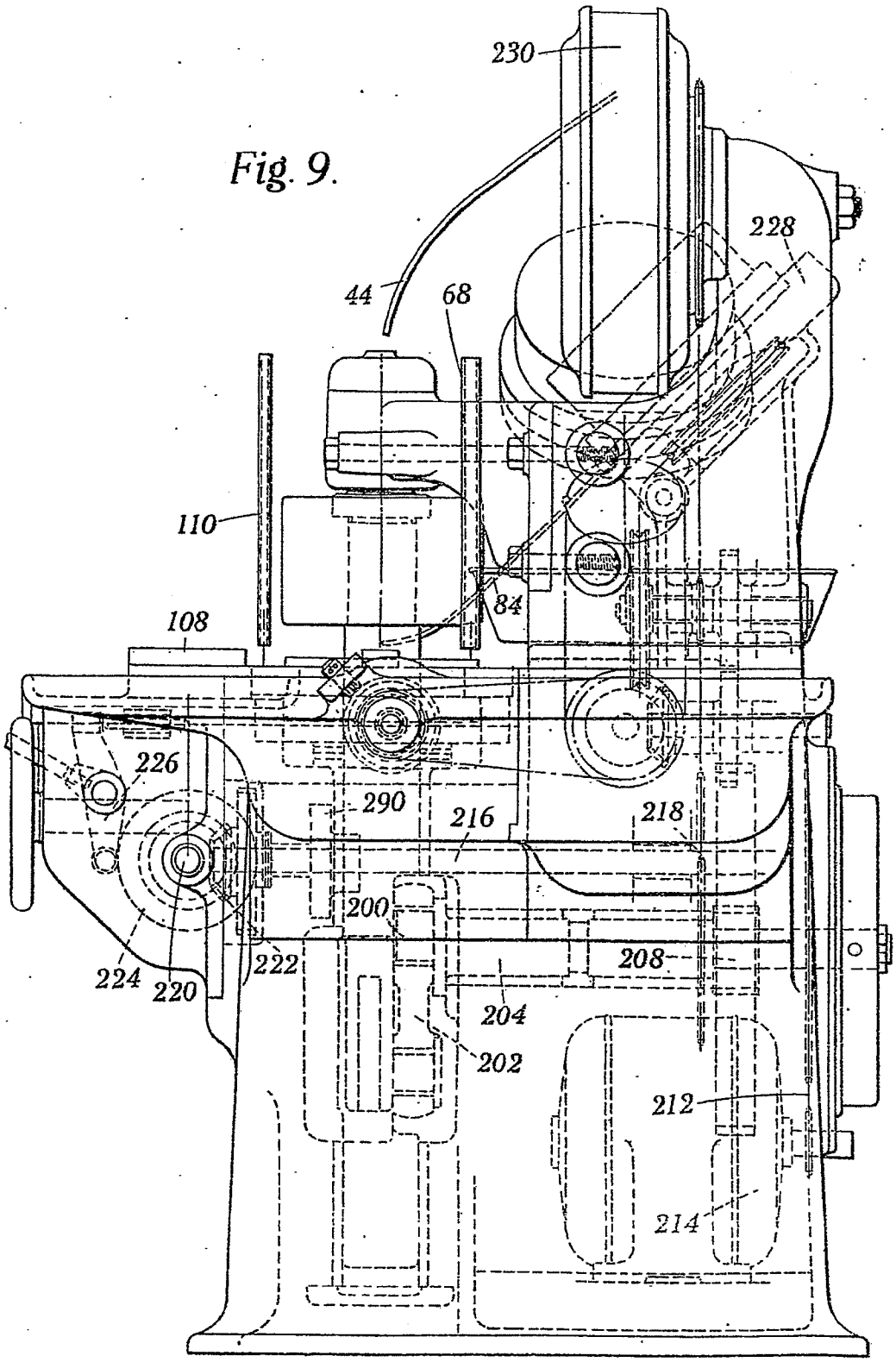

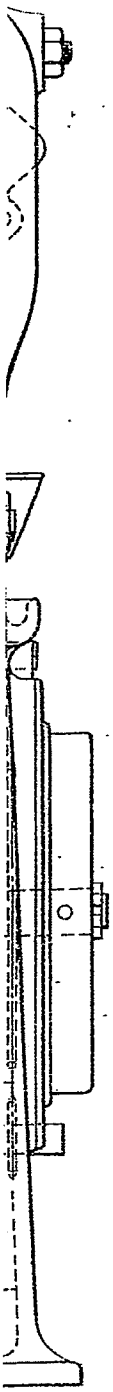

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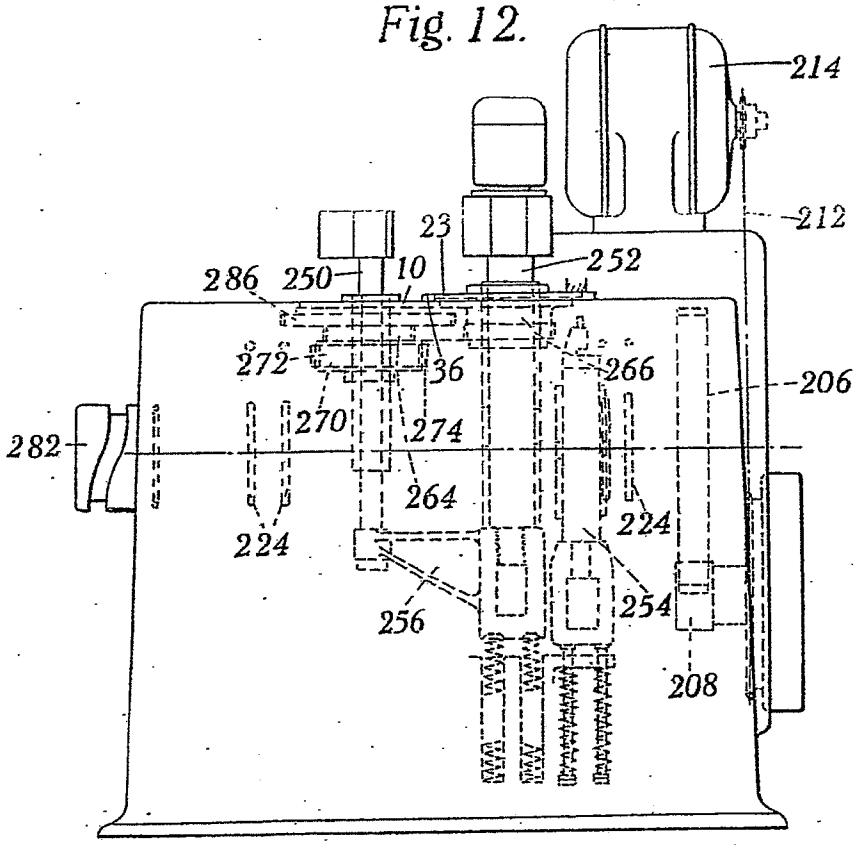

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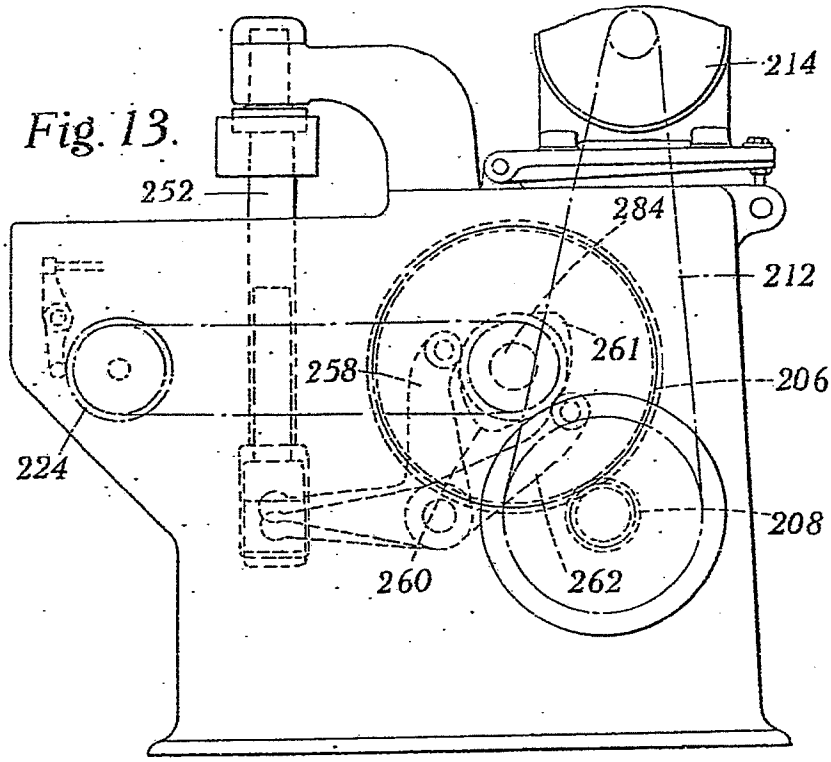

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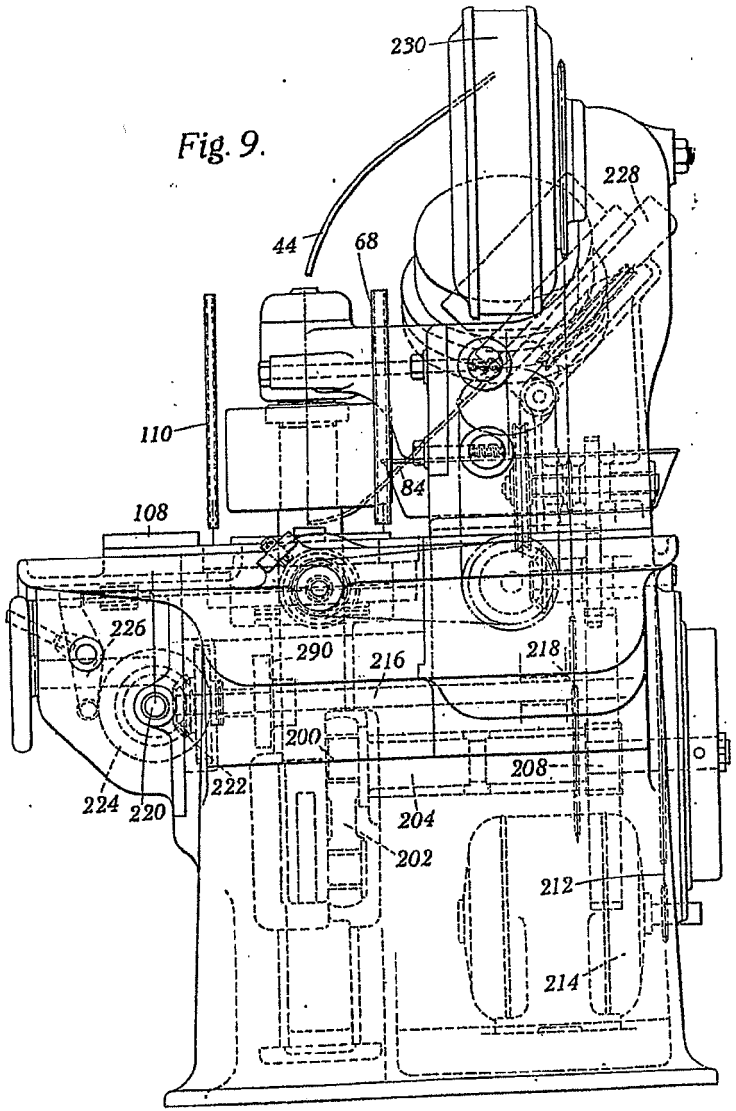
Fig. 9.



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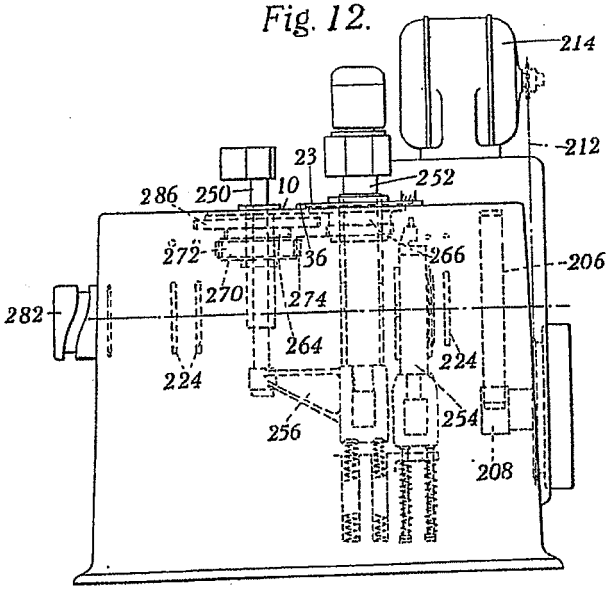

Fig. 13.